

# **ATLAS RX-110**

**AMATEUR BAND RECEIVER**

## **INSTALLATION and OPERATION MANUAL**



# **ATLAS TX-110**

## **TRANSMITTER MODULE**

### **INSTALLATION and OPERATION MANUAL**



ATLAS TX-110

TRANSMITTER MODULE

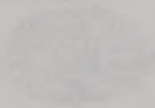
INSTALLATION

and

OPERATION

MANUAL

ATLAS  
RADIO INC.



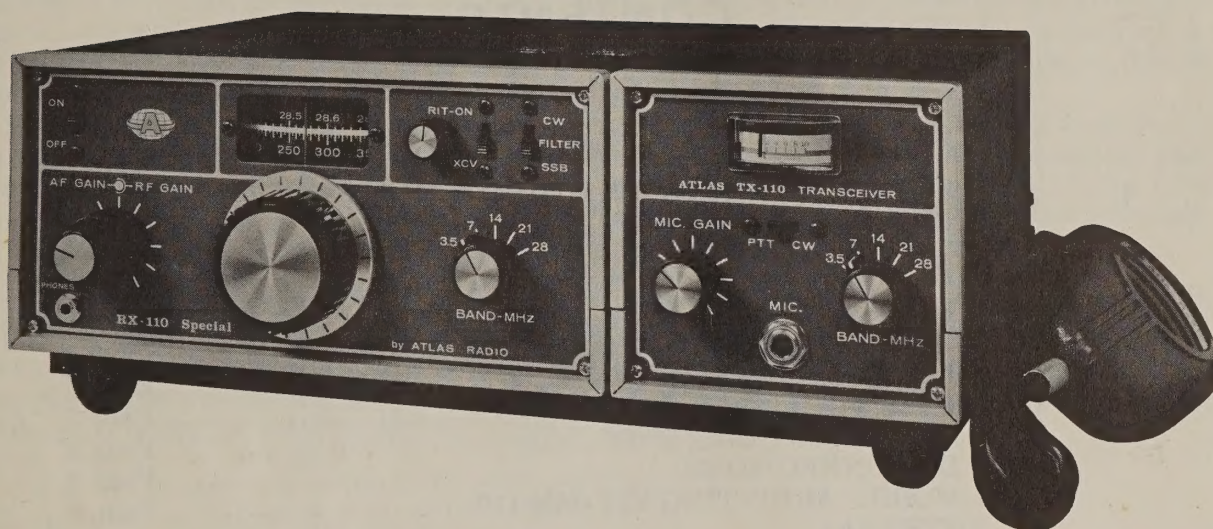
# **ATLAS TX-110**

## **TRANSMITTER MODULE**

### **INSTALLATION and OPERATION MANUAL**







## INTRODUCTION

Your Atlas TX-110 transmitter module, when connected to the Atlas RX-110 receiver, is designed to be used on CW and SSB in 5 amateur bands, 10 through 80 meters.

Combined with the RX-110, the TX-110 represents a brand new concept in receiver/transceiver design. For the first time you have a high performance receiver which can be converted into a transceiver by simply plugging in the Atlas TX-110 transmitter module. You have a choice of 20 watts input on 3.5, 7, and 14 MHz bands, 15 watts input on 21 and 28 MHz bands with the TX-110-L or 250 watts input on 3.5, 7 and 14 MHz bands, 200 watts input on 21 MHz band, and 150 watts input on 28 MHz band with the TX-110-H.

You'll find that the TX-110, in addition to being an excellent high performance transmitter, is also well built with high quality components, and a high level of craftsmanship and quality control. If you ever need repair or servicing, you'll find that the people in our customer service department are dedicated to making Atlas owners a satisfied customer.

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# INSTALLATION

## A. RX-110/TX-110 CONNECTIONS (refer to Figure 1)

The TX-110 transmitter module is shipped with two brackets for physically attaching it to the RX-110, if desired. When joining the two units together, it is necessary to turn them over, upside down, and unscrew the two front rubber feet from each unit. Lay the long 12" U-shaped bracket across the bottom of both units and replace only the outside rubber foot of each unit. It is not necessary to replace the two inside feet, but in their place install the two screws that held the feet in place. Locate the two 6-32 tapped holes on the rear panel of the RX-110 and TX-110. Secure the 4" L-shaped bracket between the two units with the 6-32 screws supplied. The RX/TX units can then be turned right side up. (Note that the units may be left unattached if desired.)

Remove the jumper plug on the back of the RX-110 and connect the multiwire cable from the TX-110 to the connector. The connectors are keyed to plug together only one way. Connect the coax with the phono plug from the TX-110 to the ANT connector on the RX-110. The RX-110 and TX-110 are now mechanically and electrically connected together and ready for operation as a transceiver.

THE GREATEST DANGER TO THE OUTPUT TRANSISTORS IS OVERHEATING. THE HEAT SINK IS DESIGNED TO COOL THE TRANSISTORS ADEQUATELY UNDER NORMAL OPERATING CONDITIONS. USE CARE WHEN INSTALLING THE TX-110 TRANSMITTER MODULE SO AS NOT TO RESTRICT AIR CIRCULATION BETWEEN THE TOP AND BOTTOM VENTILATING SLOTS ON THE TX-110 MODULE.

## B. FIXED OPERATION (Refer to Figure 2 and Figure 3).

The TX-110 is designed to operate on a power source of 14 volts DC. When connected to the RX-110 receiver, DC power is delivered to the transmitter via the built in AC supply in the receiver which provides the 14 volts low current and 9 volts regulated source for all the circuits of the low power model, TX-110-L.

When using the TX-110-H 250 watt model, the 14 volt low current circuits and 9 volt regulated source are provided by the RX-110 receiver AC supply, just as in the TX-110-L. Voltage for the 250 watt power amplifier, model PA-200, is supplied from the separate PS-110-H high current AC supply. The high current DC from the PS-110-H is connected to the RX-110 through its DC connector, and then routed through the 12 pin connector plug to the TX-110-H transmitter module.

An AC receptacle is provided on the rear panel of the PS-110-H power supply and allows for plugging in of the RX-110 AC line. The AC ON-OFF switch of the PS-110-H then also controls AC power to the RX-110 receiver. The power switch on the RX-110 can then be left on at all times if desired.

By changing internal fuses in the PS-110-H, the power supply is capable of operating on 100-130 VAC or 200-260 VAC. Because of this, **CAUTION MUST BE USED WHEN PLUGGING THE RX-110 INTO THE AC RECEPTACLE ON THE REAR PANEL OF THE POWER SUPPLY. AC VOLTAGE OF THE RX-110 MUST MATCH THE AC VOLTAGE USED FOR THE PS-110. IN OTHER WORDS, IF THE PS-110-H IS FUSED FOR 230 VAC OPERATION, DON'T PLUG THE RX-110 INTO THE REAR AC RECEPTACLE UNLESS IT IS A 230 VOLT MODEL.** The AC receptacle can also be used for other accessories such as a clock or light, providing current drain does not exceed 3 amps.

## C. MOBILE AND PORTABLE (Refer to Figure 2 and Figure 3).

1. **DCC-110.** For mobile or portable operation DC power is delivered to the TX-110 the same way as in fixed operation, via the RX-110 receiver. DC power can be delivered to the RX-110 receiver via the DCC-110 cable available from Atlas dealers. The DC cable is designed with built-in polarity and fuse protection, and is recommended when using battery power. Included with the cable is all necessary hardware. The DCC-110 cable can be used with both low and high power transmitter modules. A 25 amp circuit breaker is supplied with the TX-110-H (250 watt version) and should be connected in series with the battery lead next to the battery.

# TX-110 SPECIFICATIONS

**NOTE:** The TX-110 combines with the Atlas RX-110 receiver to form a 5 band transceiver. The TX-110 is not a transmitter by itself, since it is dependent on certain portions of the RX-110 before it will function as a transmitter. **LOW POWER MODEL, TX-110-L** (Driver stage only) runs 20 watts input on 3.5, 7 and 14 MHz bands, 15 watts input on 21 and 28 MHz bands. **HIGH POWER MODEL, TX-110-H** (Includes push-pull Power Amplifier, model PA-200 installed internally). 250 watts input on 3.5, 7 and 14 MHz bands, 200 watts on 21 bands, and 150 watts on 28 MHz bands.

**NOTE 1:** The PA-200 Power Amplifier may be factory installed inside the TX-110-L Transmit Module at a later date.

**NOTE 2:** Power specifications are made with nominal supply voltage of 115 volts AC or 14 volts DC.

**FREQUENCY COVERAGE:** Same as RX-110 receiver.

**BROAD BAND DESIGN:** No transmitter tuning.

**HARMONIC AND SPURIOUS INPUT:** Exceeds FCC requirements of 40 db down by wide margin. Typically better than 50 db.

**CARRIER SUPPRESSION:** More than 40 db; typically 60 db down.

**UNWANTED SIDEBAND:** More than 50 db; typically 60 db down.

**THIRD ORDER DISTORTION:** Approximately 30 db below peak power.

**MODES OF OPERATION:** CW transmit with semi-break-in keying as a standard feature. Sidetone is provided to the RX-110 audio, for monitoring of CW keying. CW transmit frequency is offset from receive frequency by 800 Hertz. SSB voice transmission, lower sideband on 3.5, 7 MHz bands, upper sideband on 14, 21 and 28 MHz.

**CW KEYING CIRCUIT:** 12 volts @ 125 ma. positive to chassis ground. Requires 2 circuit 1/4 in. phone plug (not supplied).

**MICROPHONE:** High impedance dynamic or crystal, with PTT (Press-to-talk) switch or button. Requires 3 circuit 1/4 in. phone plug (not supplied).

**METERING:** Front panel meter indicates relative power output. Varies with antenna load, and frequency. Pin jacks on rear panel of TX-110 may be used to measure collector current to the driver stage (0-2 Ampere Range). Ammeter accessory, model TX-2A, is available from Atlas Dealer, or Atlas Radio, Inc. Standard 1/4 in. jack on rear panel of PS-110 (Separate AC supply for 250 watt amplifier) may be used to measure collector current to 250 watt amplifier (0-25 Ampere Range).

**CONNECTOR CABLES** extend from rear of Transmitter Module, and plug into rear of RX-110 receiver, making all necessary connections for transceiver operation.

**HARDWARE AND BRACKETS** are supplied to physically join the TX-110 and RX-110, making them an integral unit.

**SIZE AND WEIGHT:** 4-1/8 in. (10.5 cm) wide, 3-3/4 in. (9.5 cm) cabinet height, 9-3/4 in. (24.8 cm) cabinet depth. Net weight: TX-110-L, Low Power Module, 3 lbs (1.4 Kg). Shipping weight: 4 lbs (2.1 Kg). Add 1 lb (0.5 Kg) for TX-110-H, High Power Module.

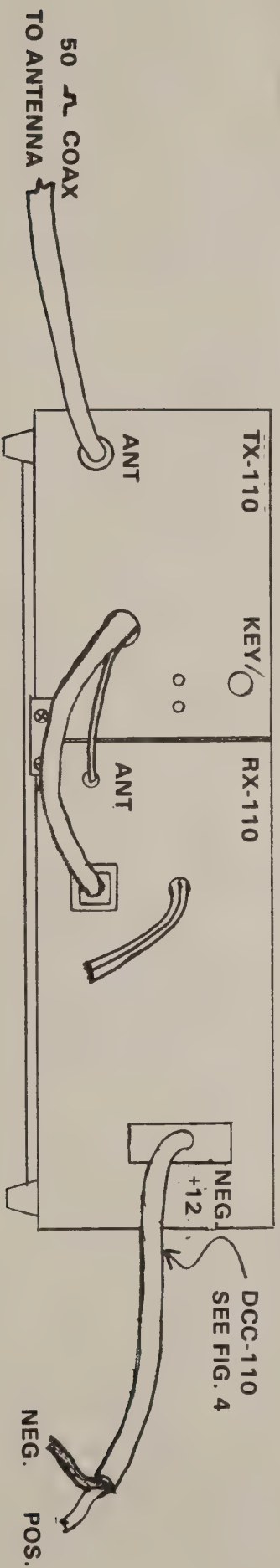
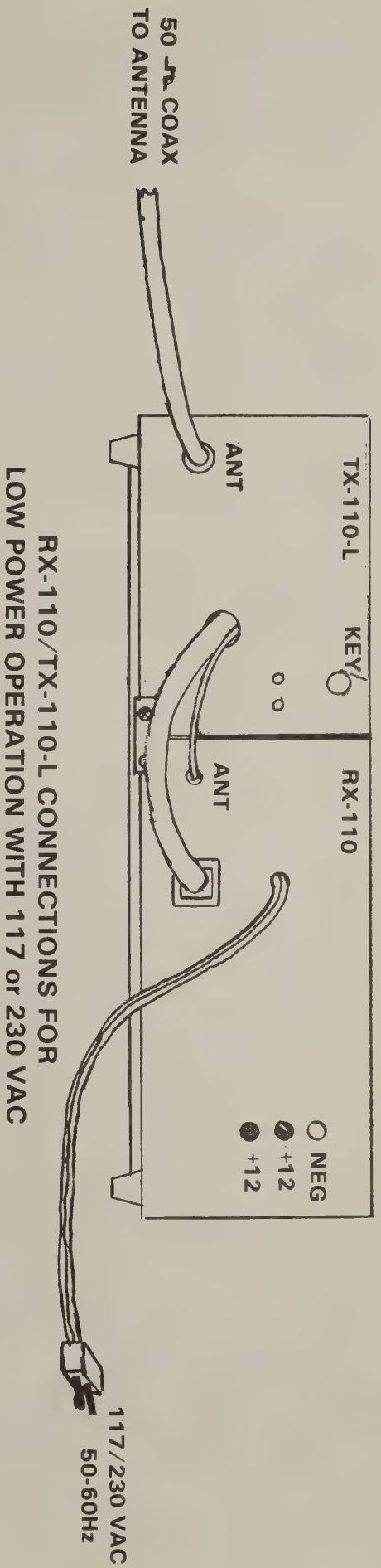
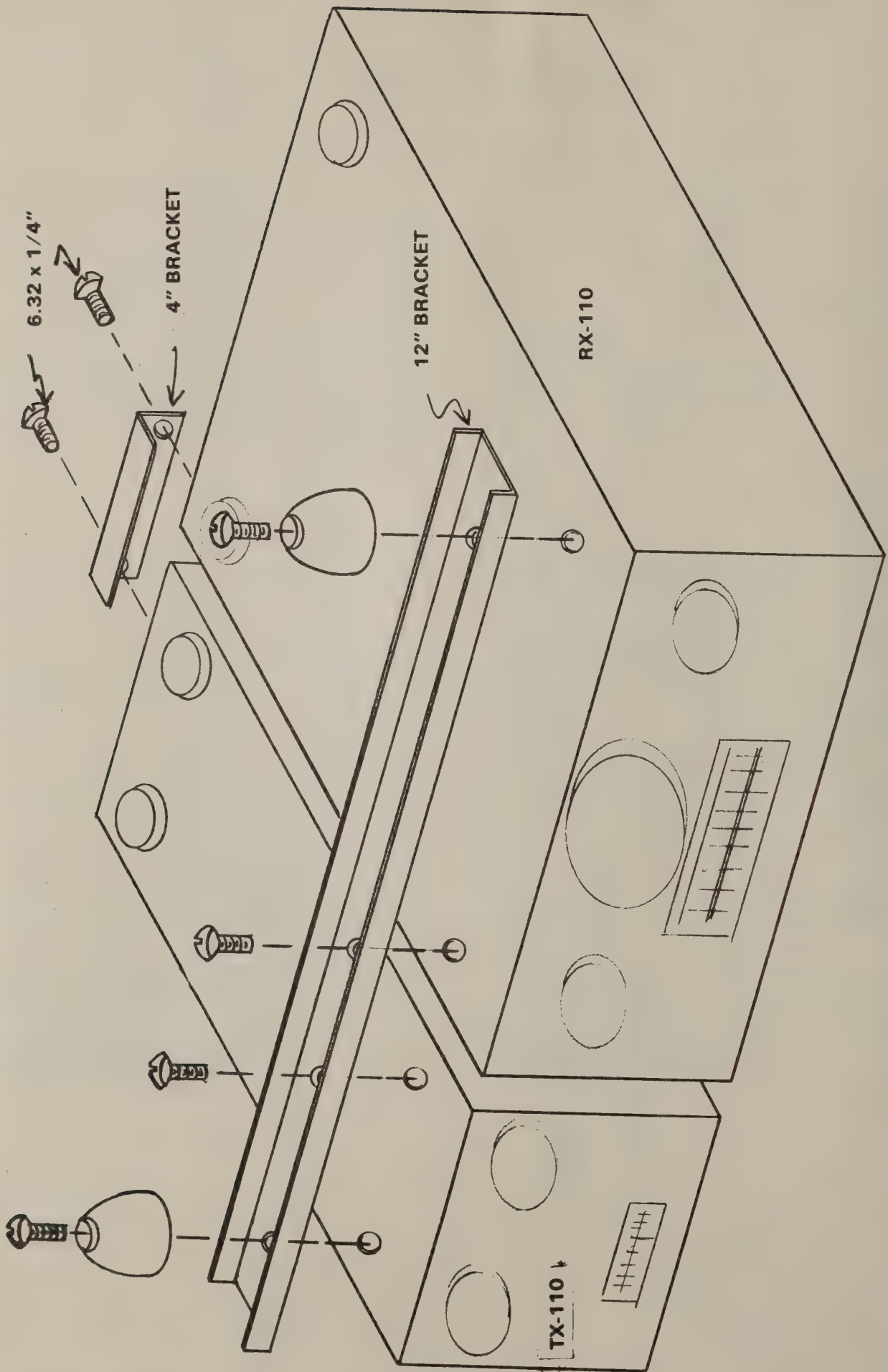


FIG. 2



RX-110/TX-110 BRACKET ASSEMBLY  
FIG. 1

**2. Alternate DC Connections.** In the event you do not use the DCC-110 cable for the RX-110/TX-110 DC installation, connections can be made to the two banana plugs on the rear panel of the RX-110 for the positive battery lead. It is recommended that a 3 amp fuse be connected between the two banana plugs. Then connect the battery lead to the upper banana plug marked +12 to 14 VDC, 16 amps. The wire should be of No. 10 or 12 gauge. A 25 amp circuit breaker is supplied with the TX-110-H (250 watt version) and should be connected in series with the battery lead *close to the battery*. Figure 3 illustrates alternate DC connections to the RX-110/TX-110.

**3. Mobile Mounting Kit (MM-110).** The mobile mounting kit is a plug-in unit designed for easy plug-in and removal of the RX-110/TX-110 combination. All DC power connections are made to the MM-110 and all necessary hook-up cables, including the DC battery cable with circuit breaker and hardware are part of the kit.

## D. ANTENNAS

**1. Fixed.** On 10, 15, and 20 meters a dipole and most beam antennas will work well across the entire band. On 40 meters a typical dipole tuned for the phone band center will match quite well across the entire band. The 3.5 to 4.0 MHz frequency range is considered to be two bands. 3.5 to 3.8 MHz is the 80 meter band and 3.8 to 4.0 MHz is the 75 meter band. The typical dipole will have a bandwidth of about 100 KHz for SWR of 1.5:1 or less. Because of the difficulty in having more than one antenna of length required for the 3.5 to 4.0 MHz range it is recommended that the antenna be tuned for the frequency that is likely to be used most often. Efficiency and power output will quickly drop off as you tune away from resonance.

The dipole is the basic shortwave receiving and transmitting antenna. Its length is equal to about one-half the wavelength of the desired operating frequency. (The symbol for wavelength is  $\lambda$ ). It is usually made of wire and supported at the ends by insulators. The radiation and capture pattern of the horizontal antenna is bi-directional, perpendicular to the plane of the antenna.

50 ohm coax cable feed line is connected at the center, with the coax shield to one side, and the coax center conductor to the other side. The total length of a wire dipole may be computed from the following formula:

$$\text{Length in Feet} = \frac{468}{\text{Frequency MHZ}}$$

EXAMPLE: Desired operating frequency is 14.3 MHz. The length of the halfwave dipole is:  
 $\text{length} = \frac{468}{14.3}$  or 32.7 feet end to end.

Novices will be interested to know that a 40 meter dipole cut to the 7100 KHz makes a very good antenna on the 15 meter novice band.

When space limitations restrict construction of lengthy horizontal antennas, a general coverage vertical antenna may be desired. Vertical antennas receive and transmit in all directions. They are usually a quarter wavelength in height and require horizontal "radials," preferably each being one quarter wavelength in length, spread equally around the vertical radiator. The length of a quarter wave element is:

$$\text{Length in feet} = \frac{234}{\text{Frequency MHZ}}$$

EXAMPLE: Desired operating frequency is 14.3 MHz. Vertical length is

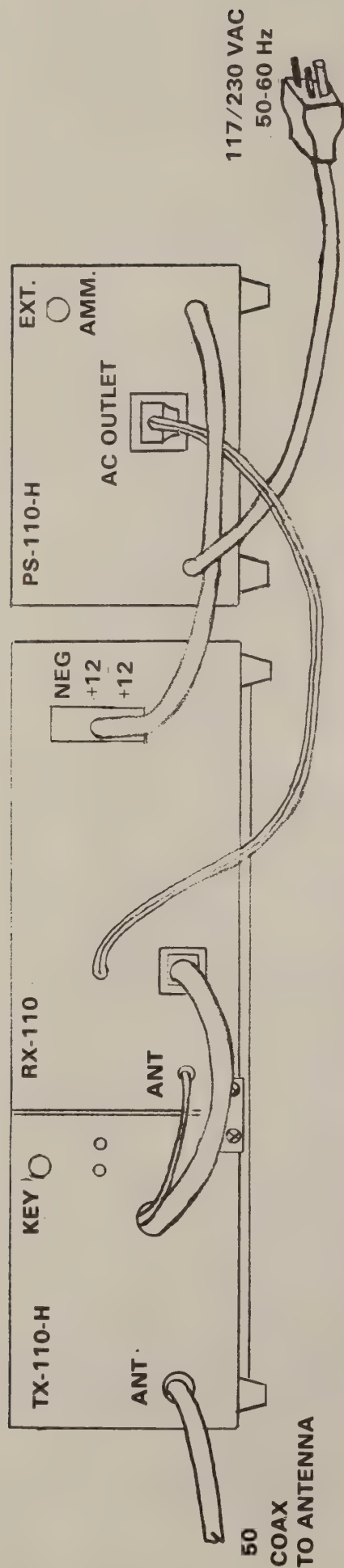
$$\text{Length} = \frac{234}{14.3} \text{ or } 16.3 \text{ feet. The 50 ohm coaxial cable is fed directly to the antenna.}$$

The coax shield is connected to the radial or ground system, and the center conductor is connected to the vertical radiator.

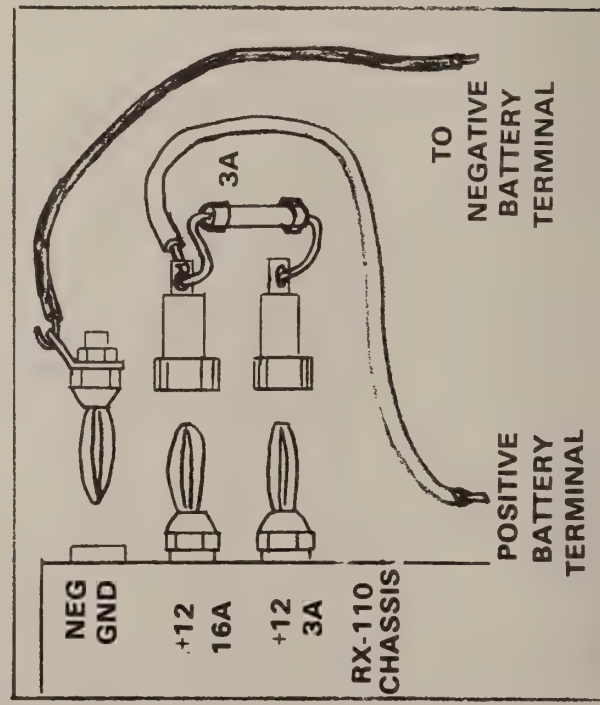
Multi-band vertical and horizontal antennas are also available for amateur band use. Band selection is made possible by the resonant circuits known as "traps" placed along its length. Once the antenna has been installed there is no need for adjustments when bands are switched.

Directional beam type antennas are also available. Because of size limitations, this type of antenna is normally restricted to 10, 15, and 20 meter use only. This antenna is of the dipole type, but with additional elements added to increase both transmitting and receiving gain. The multi-element beam antenna is highly efficient for long distant communications. You will usually see these antennas mounted on high towers.

NOTE: Most of these types of antennas and books and magazines describing different kinds of antenna systems are available at most amateur radio dealers.



RX-110/TX-110-H/PS-110-H CONNECTIONS  
FOR HIGH POWER OPERATION WITH 117 or 230 VAC



ALTERNATE  
DC CONNECTIONS

FIG. 3

**ANTENNA TUNER**  
**OPERATING NOTES WHEN USED WITH SOLID STATE TRANSMITTERS.**  
**VERY IMPORTANT. DO NOT FAIL TO READ.**

**IF YOU ARE USING AN ANTENNA TUNER BETWEEN YOUR TRANSMITTER AND ANTENNA SYSTEM, READ THE FOLLOWING NOTES CAREFULLY.** The highly reactive loads which can be created by misadjustment of some antenna tuners may cause spurious oscillation.

**A. ALWAYS USE AN SWR BRIDGE BETWEEN THE TRANSMITTER AND THE TUNER.** Some tuners have a bridge built in. If yours does not, install a separate one.

**B. ALWAYS TUNE WITH MINIMUM REQUIRED POWER!** Set the Sensitivity, or "SET" control on the bridge to maximum, full clockwise. Then use the transmitter drive control for setting the meter on the bridge to full scale. **NOTE:** This must be done with the bridge in "FWD," "FORWARD," or "SET" position.

**C. NEVER ADJUST THE ANTENNA TUNER WITH THE TRANSMITTER RUNNING AT HIGHER POWER LEVELS.** Most antenna tuners can be adjusted to produce highly reactive conditions. At the higher power levels, this may be hazardous to the final amplifier devices, whether tubes or transistors. *Evidence of such misuse may void your warranty!*

**D.** Most tuners come with instructions, but some are rather inadequate. Generally they have "Transmitter" and an "Antenna" control, plus an "inductance" switch. Begin tuning with these controls at their midrange. Read the SWR, and then rotate the inductance switch to the position that gives the lowest reading. Then turn the transmitter and antenna controls to reduce the SWR to the lowest possible reading. You should reach an SWR of 1.5 quite easily. If not, there is a serious problem with the antenna.

**E.** Once you have found the correct settings for each band, make up a chart. Use this chart as a reference each time you change bands, so that you can quickly set the controls to their approximate positions, and then quickly fine tune them.

**F.** If the procedures above are followed regularly, your P.A. finals will enjoy a long and trouble free life.

**2. Mobile.** The mobile antenna generally requires more critical adjustment than the home station antenna. This is because it operates over a more narrow bandwidth, and must therefore be adjusted very accurately for resonance. Also, the base impedance is seldom very close to 52 ohms. With tube type transmitters the Pi matching network will adjust to fairly low impedances, but with a broadband solid state amplifier, such as used in all Atlas Transceivers, a close impedance match is necessary in order to operate at full power. Various claims about impedances are made by manufacturers of mobile antennas, but unfortunately our tests on all the most popular brands indicate that your chances of coming up with a close match are less than 1 in 10. Average base impedance is 18 to 23 ohms. Therefore, some method of transforming the antenna base impedance to 52 ohms is required. A matching transformer, model MT-1, is available from your Atlas dealer and is designed to provide a proper impedance match between the HF (High Frequency) mobile antenna and the 50 to 53.5 ohm coaxial feedline. With the MT-1 transformer a tap selection will be found which will provide SWR readings of 1.4:1 or less when using the common type mobile antennas, such as those manufactured by Nutronics, Swan and HyGain. (Note: The MT-1 transformer will probably not be required when the mobile antenna is installed on a motor home, or on a boat. Ground area on these installations increases radiation resistance to where it is very close to 50 ohms.)

**3. Transmission Line Match.** Proper impedance match between the coaxial feedline and the antenna system is much more important with the broadband solid state amplifier than with tube type transmitters. The SWR should be as low as possible in order to permit full power operation. The greater the SWR reading means a greater amount of reflected power, resulting in poor efficiency of the transmitter and antenna system.

**4. Antenna Tuner.** An antenna tuner or transmatch can be a very useful device to compensate for antenna mismatch. Older tube type transmitters usually have some type of Pi network tuning system that will compensate for mismatched antennas. Today's solid state or broadbanded transmitters require a 50 ohm impedance match with the antennas, and if it is not possible to "TUNE" the antenna to this impedance, an antenna tuner is recommended. Obviously, the best solution is to tune the antenna system or otherwise correct the impedance mismatch at the antenna.

If an antenna tuner is to be used read the following notes very carefully.

## OPERATING NOTES

### CAUTION

THE POWER TRANSISTORS IN YOUR TRANSCEIVER CAN BE DAMAGED BY IMPROPER OPERATING PROCEDURE

WARNING: WARRANTY MAY BE VOIDED IF EVIDENCE INDICATES IMPROPER OPERATION. JUST AS YOU CAN BURN OUT THE POWER TUBES IN A TUBE TYPE RIG, OR DAMAGE ANY EQUIPMENT BY MISUSE, YOU CAN ALSO BE RESPONSIBLE FOR CAUSING DAMAGE TO YOUR SOLID STATE TRANSCEIVER. READ ALL INSTRUCTIONS CAREFULLY.

(1) IF YOU USE AN ANTENNA TUNER, DO NOT OPERATE AT FULL POWER INPUT FOR MORE THAN 5 TO 10 SECONDS AT A TIME. REDUCE POWER TO 1/4 OR LESS WHILE MAKING TUNER ADJUSTMENTS. THERE IS NO NEED TO RUN FULL POWER WHILE TUNING.

(2) SSB OPERATION: NOTE THE FOLLOWING CORRECTION TO PAGE 12 OF THE TX-110 MANUAL:

Caution: DO NOT HOLD KEY DOWN AT FULL POWER FOR MORE THAN 5 TO 10 SECONDS. SWITCH BACK TO SSB ON FRONT PANEL, TURN MIC GAIN FULL COUNTER CLOCKWISE, AND INSERT MICROPHONE IN MIC JACK. WHILE SPEAKING INTO THE MICROPHONE, SLOWLY ADVANCE MIC GAIN UNTIL METER AVERAGES ABOUT 1/3 TO 1/2 OF THE MAXIMUM CW READING. DO NOT EXCEED THIS LEVEL BECAUSE IT WILL CAUSE OVER MODULATION, DISTORTION, AND ALSO OVERDRIVE THE POWER TRANSISTORS.

(3) CW OPERATION: DO NOT OPERATE AT FULL MIC GAIN (CARRIER INSERTION) ON 80, 40, or 20 METERS. ON THESE BANDS IT IS POSSIBLE TO RUN IN EXCESS OF THE 250 WATT POWER RATING. OBSERVE THE MAXIMUM OUTPUT READING THAT CAN BE REACHED AT FULL POWER. (DO NOT HOLD AT FULL POWER FOR LONGER THAN 5 TO 10 SECONDS). THEN BACK THE MIC GAIN DOWN TO ABOUT 3/4 OF THE MAXIMUM READING.

IF YOU ARE USING THE ATLAS TX-2A AMMETER (OR SOME OTHER AMMETER AFTER REMOVING POWER SUPPLY SHUNT. SEE PAGE 12). OPERATE CW WITH MIC GAIN (CARRIER INSERTION) SET FOR NO MORE THAN 20 AMPS WHEN USING THE PS-110-H SUPPLY. THESE AMMETER READINGS WILL CORRESPOND TO 250 WATTS INPUT.

ALWAYS OBSERVE SIGNS OF EXCESSIVE HEAT COMING FROM THE P.A. HEATSINK, AND REDUCE POWER IF IT APPEARS TO EXCESSIVE.

ANTENNA TUNER, OPERATING NOTES WHEN USED WITH SOLID STATE TRANSMITTERS.

VERY IMPORTANT. DO NOT FAIL TO READ.

IF YOU ARE USING AN ANTENNA TUNER BETWEEN YOUR TRANSMITTER AND ANTENNA SYSTEM, READ THE FOLLOWING NOTES CAREFULLY. The highly reactive loads which can be created by misadjustment of some antenna tuners may cause spurious oscillation.

(A) ALWAYS USE AN SWR BRIDGE BETWEEN THE TRANSMITTER AND THE TUNER. Some Tuners have a bridge built in. If yours does not, install a separate one.

(B) ALWAYS TUNE WITH MINIMUM REQUIRED POWER! Set the Sensitivity, or "SET" control on the bridge to maximum, full clockwise. Then use the transmitter drive control for setting the meter on the bridge to full scale. NOTE: This must be done with the bridge in "FWD", "FORWARD", or "SET" position.

(C) NEVER ADJUST THE ANTENNA TUNER WITH THE TRANSMITTER RUNNING AT HIGHER POWER LEVELS. Most antenna tuners can be adjusted to produce highly reactive conditions. At the higher power levels, this may be hazardous to the final amplifier devices, whether tubes or transistors. Evidence of such misuse may void your warranty!

(D) Most tuners come with instructions, but some are rather inadequate. Generally they have "Transmitter" and an "Antenna" control, plus an "inductance" switch. Begin tuning with these controls at their midrange. Read the SWR, and then rotate the inductance switch to the position that gives the lowest reading. Then turn the transmitter and antenna controls to reduce the SWR to the lowest possible reading. You should reach an SWR of 1.5 quite easily. If not, there is a serious problem with the antenna.

(E) Once you have found the correct settings for each band, make up a chart. Use this chart as a reference each time you change bands, so that you can quickly set the controls to their approximate positions, and then quickly fine tune them.

(F) If the procedures above are followed regularly, your P.A. finals will enjoy a long and trouble free life.

# OPERATION

**NOTE:** The TX-110 combines with the Atlas RX-110 receiver to form a 5 band transceiver. The TX-110 is not a transmitter by itself, since it is dependent on certain portions of the RX-110 before it will function as a transmitter. Connections to the RX-110 are outlined in Section II of the RX-110 manual.

**CAUTION: CARE MUST BE TAKEN WHEN OPERATING NEAR BAND EDGES WITH THE TX-110 TRANSCEIVER. ALTHOUGH DIAL ACCURACY IS QUITE GOOD ON THE RX-110 RECEIVER SOME TYPE OF ACCURATE FREQUENCY MEASUREMENT IS RECOMMENDED AND REQUIRED BY FCC REGULATIONS. A CALIBRATED EXTERNAL RECEIVER CAN BE USED OR POSSIBLY A LOCAL HAM FRIEND CAN LISTEN TO YOUR TRANSMIT FREQUENCY AND RELAY YOUR OPERATING FREQUENCY TO YOU. WHATEVER METHOD IS USED, IT IS RECOMMENDED THAT PERIODIC MEASUREMENTS BE MADE TO INSURE PROPER OPERATION WITHIN BAND EDGES OF EACH OPERATING RANGE.**

## **A. FRONT PANEL CONTROLS (Refer to Figure 4).**

1. **MIC. GAIN.** Modulation level is adjusted with the MIC. GAIN. control. When the transceiver is coupled into a proper 52 ohm load, voice peaks will be reaching about 16 amps or greater on the high power TX-110-H and about 1.6 amps or greater on the low power TX-110-L.

a. **SSB OPERATION.** The front panel meter indicates relative output only and not transmitter collector current (amps). In order to set MIC. GAIN. for correct modulation level it will be necessary to plug a CW key into key jack on rear panel, switch SSB-CW on front panel to CW, insert full MIC. GAIN. (full clockwise position), key the transmitter and observe meter reading. **CAUTION: DO NOT HOLD KEY DOWN AT FULL POWER FOR MORE THAN 5 TO 10 SECONDS.** Switch back to SSB (PTT on earlier models) on front panel, turn MIC. GAIN. full counter clockwise, and insert microphone into MIC. jack. While speaking into the microphone, slowly advance MIC. GAIN. until meter averages about 1/3 to 1/2 of the maximum CW reading. Do not exceed this level because it will cause over modulation, distortion, and also overdrive the power transistors.

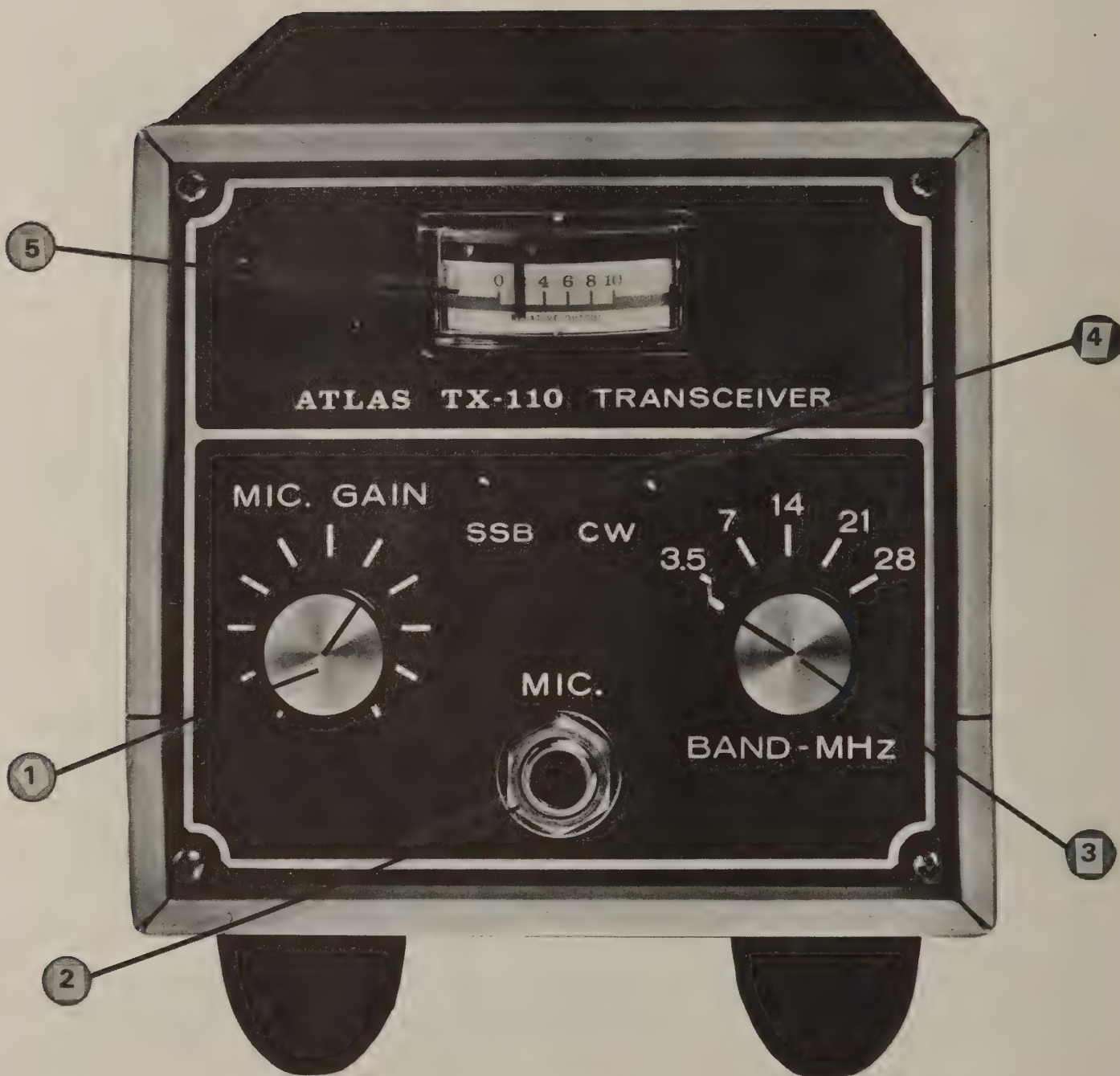
b. **CW OPERATION.** Do not operate at full MIC. GAIN. (carrier insertion) on 80, 40, or 20 meters. On these bands it is possible to run in excess of the 250 watt power rating. Observe the maximum output reading that can be reached at full power. (Do not hold at full power for longer than 5 to 10 seconds.) The back the MIC. GAIN. down to about 3/4 of the maximum reading.

c. **EXTERNAL AMMETER.** To use an external ammeter for reading of collector current on the TX-110-L low power transmitter module it is only necessary to locate the two tip jacks on the rear panel of the transmitter module and install the leads from the ammeter into these tip jacks, observing proper polarity. An external ammeter accessory, Model TX-2A, is available from your Atlas dealer and provides accurate collector current readings for both the TX-110-L and TX-110-H transmitter modules. If another ammeter is available for use with the TX-110-L, it may be used by removing the shunt that is connected across the two tip jacks.

When using the TX-110-H high power transmitter module, the PS-110-H power supply is required to supply the high current needed for the PA-200 power amplifier. A standard 2 circuit 1/4" phone jack is provided on the rear panel of the PS-110-H and can be used for installing the Atlas TX-2A ammeter. If another ammeter is available for use with the TX-110-H, it may be used by removing the shunt which is connected across the meter jack in the power supply.

When using an ammeter, adjust MIC. GAIN. control for average readings of 6 to 8 amps on the high power TX-110-H and .6 to .8 amps on the low power TX-110-L in the SSB mode. Operate CW with MIC. GAIN. (carrier insertion) set for no more than 20 amps when using the PS-110-H supply.

2. **MIC.** The microphone may be either a dynamic or crystal type. A low impedance MIC will work, but will require higher setting of the MIC. GAIN. control, and may require closer speaking. If a dynamic MIC. is used, it should preferably be the high impedance type. The choice of



**FIG. 4**  
**FRONT VIEW**

microphones is important for good speech quality, and deserves careful consideration. Select a high quality MIC with smooth response from 300 to 3000 Hz or more. The Atlas 404C hand MIC and the Atlas 444 desk MIC are excellent choices. The plug required for the MIC connector is a standard 1/4 inch diameter 3 conductor type. The tip connection is the keying circuit for push-to-talk (PTT), the ring connection is for the shielded MIC lead, and the sleeve or barrel is the common ground terminal.

3. **Band Selector.** Numbers read in MegaHertz for the respective amateur bands: 3.5 for the 80 meter (3.5-3.8 MHz) and 75 meter band (3.8-4.0 MHz), 7 for 40 meters, 14 for 20 meters, 21 for 15 meters, and 28 for the first MegaHertz portion of 10 meters (28 to 29 MHz). Bandswitch position on the TX-110 must correspond to the bandswitch position on the RX-110 for proper transceiver operation.

4. **SSB-CW.** Selects mode of operation desired. With switch in the SSB position voice transmission is on the normally used sideband; lower sideband on 80 and 40 meters, and upper sideband on 20, 15, and 10 meters. Moving to the CW position automatically switches the transmitter to the CW transmit mode. A 1.4 inch diameter key jack is provided on the rear panel for insertion of a CW key.

5. **Meter.** Reads relative power output on scale of 0 to 10. (Varies between sets.)

## **B. REAR PANEL CONTROLS (Refer to Figure 5).**

6. **Antenna.** An SO-239 connector connects the transceiver to the antenna system. The RX-110 receiver is automatically connected to the antenna by relays in the TX-110.

7. **External Ammeter.** Tip jacks are provided for use of the Atlas Model TX-2A external ammeter with the low power transmitter module (TX-110-L). When using the high power transmitter module (TX-110-H), provisions for the external Atlas ammeter are provided on the PS-110-H power supply which is necessary when using the high power (250 watt) transmitter module.

8. **RX-110 Connector Cable.** 12 pin plug connects to rear of RX-110 receiver and provides for all functions necessary for transceiver operation. Small coax cable plugs into antenna phono jack on rear panel of RX-110.

9. **Key Jack.** A jack is provided for insertion of a standard 1.4 inch diameter, 2 conductor phone plug. Connect the CW key to the plug with a 2 conductor cable. The sleeve connection goes to chassis ground. Keying potential is less than 10 volts, positive, and draws less than 10 milliamperes. Most of the electronics keyers presently on the market will work satisfactorily.

10. **Sidetone.** The sidetone volume trimpot is located on the PC-610 Board directly behind the TX-110 front panel. If adjustment is necessary on early models, the bottom cabinet will have to be removed and the sidetone volume level can then be set with a small screwdriver. Later models have an adjustment hole through the bottom cabinet.

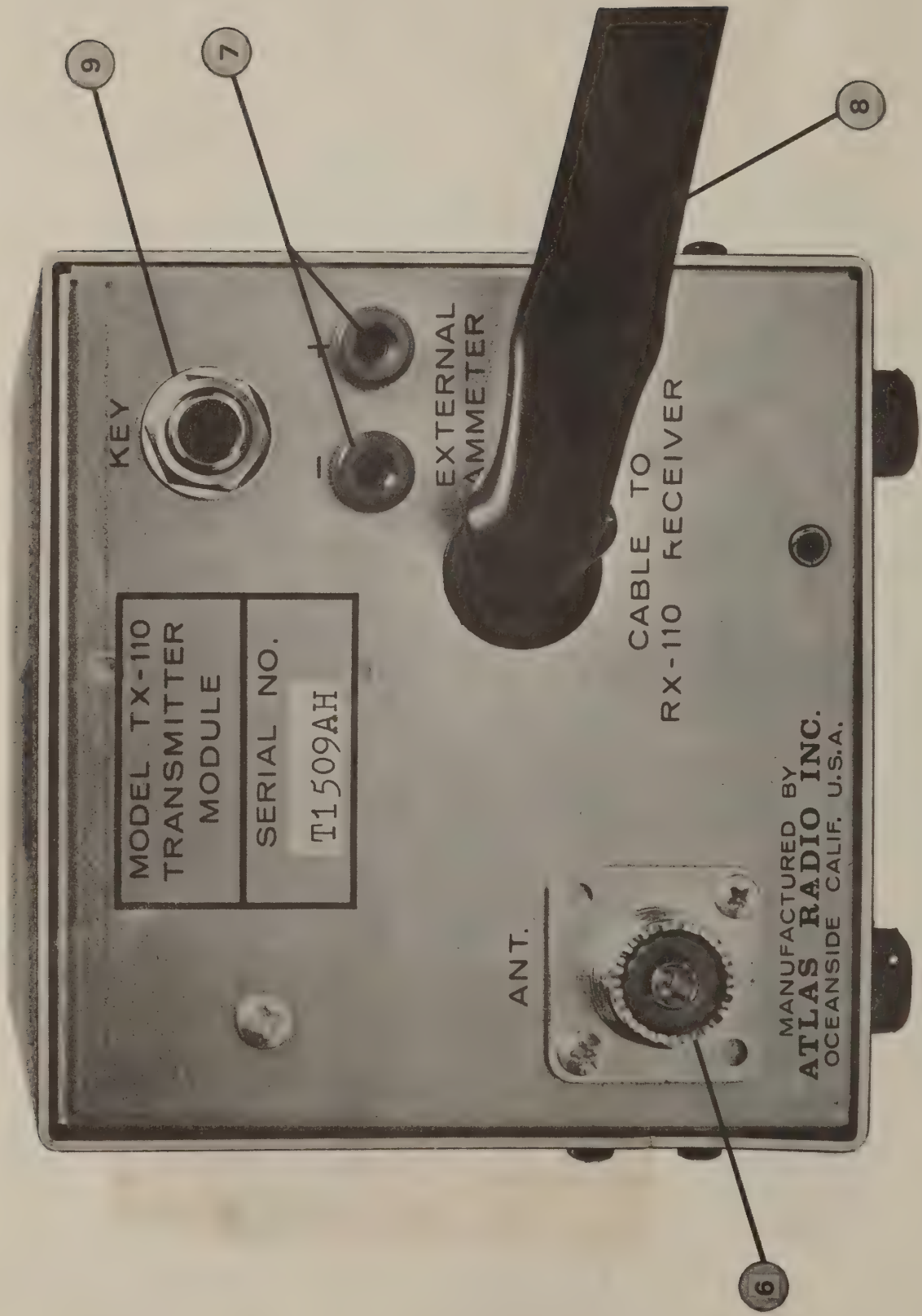


FIG. 5  
REAR VIEW

### PC-610 Audio/VOX Board

C601	2.2 mf 16V Tantalum
C602, 612, 613, 614	.01 mf 100V 20% Disc
C603, 608, 616, 620	47 mf 16V Electrolytic
C604	.0033 mf 500V 20% Disc
C605, 618, 606	.1 mf 12V 20% Disc
C607, 619	.001 mf 100V 20% Disc
C609	100 mf 16V Electrolytic
C610, 611, 615	.1 mf 50V 20% Disc
C617	22 mf 25V Electrolytic
R601, 634	470 5% 1/4 Watt
R602, 610, 612, 615, 621, 624 614, 628, 630, 628	10K 5% 1/4 Watt
R603, 611	180 5% 1/4 Watt
R604	270 5% 1/4 Watt
R605	680K 5% 1/4 Watt
R606	100K 5% 1/4 Watt
R607	2 Meg 5% 1/4 Watt
R608	47K 5% 1/4 Watt
R619, 620, 626, 635	4.7K 5% 1/4 Watt
R618	22K 5% 1/4 Watt
R609, 627	2.2K 5% 1/4 Watt
R613, 623	3.3K 5% 1/4 Watt
R616	270K 5% 1/4 Watt
R617	10K Trimpot Side Tone Adj.
R622, 625	33K 5% 1/4 Watt
L601	200 uh RF Choke
D601, 603	IN4149 Sil. Diode
D602	IN4735 Zener Diode 6.2V
D604	IN4005 Sil. Diode
Q601	MPS6514 Transistor
Q602	MPSA12 Transistor
Q603	MPS.VO1 Transistor
Q604	CA3086 Integrated Ckt.
R632	68K 5% 1/4 Watt

### PC-560, Model PA-200 Power Amplifier

C565	.1 mf 100V Mylar
C566	1000 mf 25V Electrolytic Cap
C567, 568	.01 mf 100V 20% Disc
C569, 570	.1 mf 50V 20% Disc
C571, 572	82 pf FS 10% Disc
R561, 562	150 5% 1 Watt
R563, 564, 565	10 5% 1 Watt
R566, 568	470 5% 1/4 Watt
R567	1K Trimpot Bias Adj.
R569, 570	3.3 5% 1/4 Watt
R569, 570, 572, 573	15 5% 2 Watt
R571	10 5% 2 Watt
T561	Toroid Input XMFR
T562	Toroid Output XMFR
L562, 561	1.4 uh RF Choke
L563	Parasitic Choke
L564	Toroid Choke
D561, 562	SI-05 Silicon Diode
Q561, 562	CD2545 Transistor
Q563	2N5490 Transistor

### PC-710/715 Low Pass Filter Boards

C701, 704	820 pf 5% DM-19 Sil. Mica
C702	1100 pf 5% DM-19 Sil. Mica
C703, 707	680 pf 5% DM-19 Sil. Mica
C712, 713, 714	220 pf 5% DM-19 Sil. Mica
C705	330 pf 5% DM-19 Sil. Mica
C709, 706	430 pf 5% DM-19 Sil. Mica
C716, 720, 708	100 pf 5% DM-19 Sil. Mica
C715	50 pf NPO 5% Disc
C710	120 pf 5% DM-19 Sil. Mica
C717, 711	150 pf 5% DM-19 Sil. Mica
C718, 719	180 pf 5% DM-19 Sil. Mica
L702, 703	1.8 uh Toroid
L703, 704	.95 uh Toroid
L705, 706	.48 uh Toroid
L707, 708	.32 uh Toroid
L709, 710	.24 uh Toroid

### PC-660 Relay Board

C661	4.7 pf N220 5% Disc
C664, 665, 666, 667, 668	.01 mf 100v 20% Disc
R661	68K 5% 1/4 Watt
C662	.1 mf 12V 20% Disc
C669	180 pf Disc (TX-110-H only)
L661, 662	15 uh RF Choke
D661, 662	IN270 Ger. Diode
D663	IN4005 Sil. Diode
D664	IN4149 Sil. Diode
RL-661	3P2T Relay 12VDC

### TX-110 Chassis Assembly

P4	Coax Plug to RX-110 Ant. Connector
P5	RX-110 Connector
P6, P9	Coax Jumper for TX-110-L
P6, P8	Connector Plugs for PA-200 Amp
J5	Driver Output Jack
J6	Low Pass Input Jack
C1	4000 mf 25V Electrolytic Cap
R1	470 5% 1/4 Watt
J7	Antenna Jack
J8	Key Jack
J9	Microphone Jack
J10, J11	Ammeter Jacks
S4	DPDT Slide Switch PTT/CW

# TX-110 CIRCUIT DESIGN

Refer to the block diagram, schematic, parts list, and RX-110 schematic following the circuit description.

The TX-110 alone is not a complete transmitter, since it requires the following circuits from the RX-110 or RX-110-s:

1. The BFO (Carrier Oscillator)
2. Balanced Modulator
3. Crystal Filter
4. I. F. Amplifier
5. Diode Ring Mixer
6. VFO
7. Bandpass Filters.

The transmit audio input from the MicAmp, Q601, is coupled through terminal 6 of the connector plug to balanced modulator, D311-D314, of the RX-110 receiver. The carrier oscillator injection is coupled through C320 into the balanced modulator. The output of the balanced modulator is a double-sideband, suppressed carrier signal. Output is then fed through the crystal ladder filter resulting in suppression of the unwanted sideband. The resultant single sideband signal is fed to I.F. Amplifier, Q315. The signal is coupled through D317 to the Diode Ring Mixer. The VFO injection signal is coupled to the center tap of the trifilar transformer, T112. This heterodyning action of the mixer produces the RF transmit frequency which is coupled through the bandpass filters.

The output is then fed through the coax from the RX-110 antenna connector to the antenna relay in the TX-110 module.

The signal is then coupled to the Pre-Amp, Q501. Output is coupled through amplifier Q502 to the driver, Q503. For TX-110-L low power models, output is then coupled directly to the low pass filters. For TX-110-H high power models, output from Q503 is coupled to Q561 and Q562, the power amplifiers. Output is then coupled to the low pass filters. These filters are selected by the bandswitch and reduce harmonic output to meet FCC requirements.

## PARTS LIST

### PC-510 Driver Board

C510, 504, 505, 517, 519	.01 mf 100V 20% Disc	R511	3.3 5% 1/4 Watt
C503	2200 pf FS 10% Disc	R512	680 5% 1/4 Watt
C502, 506, 509, 512, 514, 518, 522, 523	.1 mf 50V 10% Disc	R513	50 Trimpot Gain Adj.
C507, 511	22 mf 25V Electrolytic	R514, 520	150 1% 1 Watt
C513	2.2 mf 16V Tantalum	R519	470 5% 1/4 Watt
C515	200 pf 5% DM-19 Sil. Mica	R515	150 5% 1/4 Watt
C516, 520, 524	15 mf 20V Tantalum	R516	10 5% 1 watt P/O Parasitic Choke
C521	110 pf 5% DM-19 Sil. Mica	L501, 502	1.4 uh RF Choke
C525	1300 pf 5% DM-19 Sil. Mica	L503	33 uh RF Choke
D502	IN4005 Sil. Diode	L504	15 uh RF Choke
R502	3.3K 5% 1/4 Watt	L505	Parasitic Ch. on 10 ohm Res.
R503	1K 5% 1/4 Watt	T501	Bifilar Toroid
R504	10 5% 1/4 Watt	T502	Driver Input XFMR
R505, 510	180 5% 1/4 Watt	T503	Driver Output XFMR (Balun)
R501, 506, 517, 518	47 5% 1/4 Watt	Q501	MPS6514 Transistor
R507	2.7K 5% 1/4 Watt	Q502	2N3866 Transistor
R508	220 5% 1/4 Watt	Q503	CD2545 Transistor
R509	4.7 5% 1/4 Watt	D501	SI05 Si. Diode
		RL-501	SPDT Reed Relay 12 VDC

# TX-110 ALIGNMENT

## INTRODUCTION

The following procedures are shown in approximate order performed during the factory alignment of the transceiver. The following equipment is recommended for complete alignment.

1. VTVM (Vacuum Tube Voltmeter) Hewlett Packard Model 410B or equivalent
2. R.F. Signal Generator, Hewlett Packard Model 606B or equivalent
3. 150 watt Dummy Load/Wattmeter. Bird Model 43
4. Audio Generator, RCA Model WA-504B/44D or equivalent.

NOTE: Because the TX-110 transmitter module depends on functions of the RX-110 receiver, it must be connected to the receiver during any alignment procedures.

**CAUTION: WHEN PERFORMING TRANSMITTER TEST, DO NOT HOLD IN TRANSMIT POSITION WITH FULL POWER OUTPUT FOR MORE THAN 5 TO 10 SECONDS. MOST TRANSMITTER TESTS CAN BE MADE WITH ONLY A SMALL AMOUNT OF OUTPUT POWER, AND SHOULD BE DONE SO. NORMALLY, 25% OF FULL OUTPUT POWER IS ENOUGH. HOWEVER, THE TRANSMITTER SHOULD NOT BE HELD IN TRANSMIT FOR MORE THAN 30 SECONDS AT THIS OUTPUT LEVEL.**

**THE GREATEST DANGER TO THE POWER OUTPUT TRANSISTORS IS OVERHEATING. THE BLACK ANODIZED HEAT SINK IS DESIGNED TO COOL THE TRANSISTORS ADEQUATELY UNDER NORMAL OPERATING CONDITIONS, BUT IT IS UP TO THE OPERATOR TO MAINTAIN NORMAL CONDITIONS AND NOT ABUSE THE EQUIPMENT.**

NOTE: To avoid transmitting on an outside antenna during transmitter tests, connect a dummy load to the transceiver.

### 1. BIAS ADJUST.

It will be necessary to connect an external ammeter for adjusting the bias of the transmitter. Refer to Operation section of manual for external ammeter information.

#### TX-110-H (High Power Model)

Tune transceiver to 14.3 MHz. SSB/CW switch in SSB position (PTT position on early models), MIC. GAIN. full CCW. Plug microphone into MIC jack and depress MIC button into PTT mode. Observe ammeter reading. "Idling current" should be about 1 amp. If adjustment is needed, locate the large blue trimpot, R567, on PC-560 Power Amplifier board and adjust for correct bias setting.

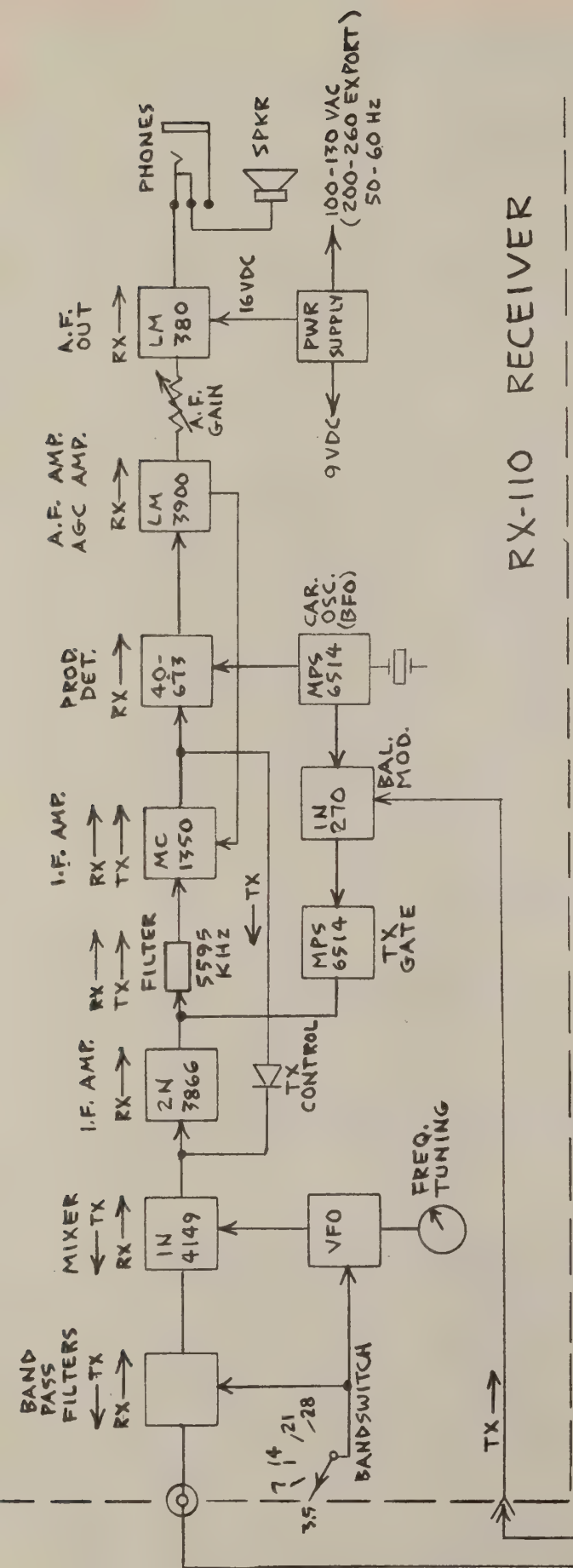
#### TX-110-L (Low Power Model)

The low power transmitter version uses the driver stage as its "final" output and is biased with a 3.3 ohm fixed resistor, R511. Ammeter readings should be about 1/2 amp. If adjustment is necessary, the 3.3 ohm resistor will have to be replaced with either a higher or lower value, depending on the amount of change needed.

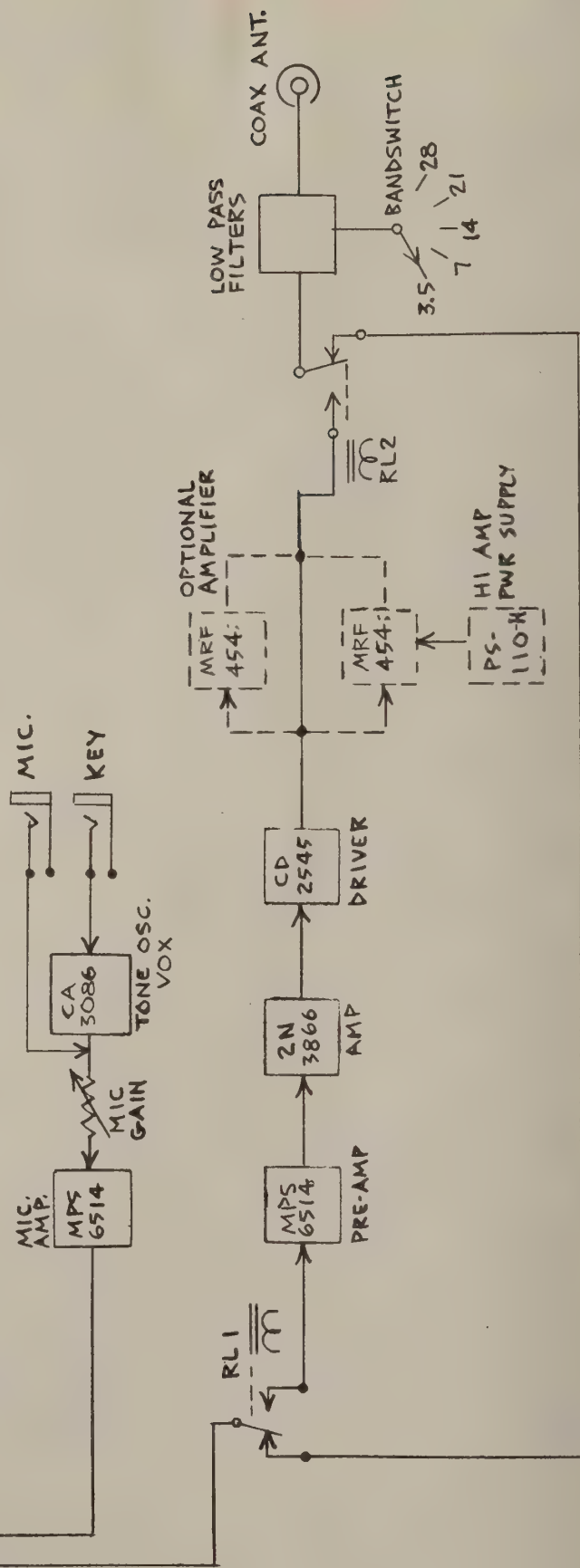
### 2. BANDPASS FILTER COILS

These coils are located in the RX-110 on PC-050 and are used in both receive and transmit. If adjustment of these coils is necessary it is recommended this be done in the transmit mode. If the coils are adjusted in the receive mode as outlined in the RX-110 manual they may not be "peaked" for transmit. This is because the coils tune broader in receive than in transmit. This is fine for receiving but may result in slight loss of output power in transmit. Remove the RX-110 top cabinet and then connect the TX-110. Connect dummy load and wattmeter into ANTENNA connector of TX-110. (If wattmeter is unavailable, use an external ammeter.) SSB-CW switch in CW position. MIC. GAIN. full CCW. Bandswitches in proper positions. Insert CW key into jack on rear panel of TX-110. Locate bandpass coils that correspond to bandswitch positions. Key transmitter and insert MIC. GAIN. until wattmeter or ammeter reading begins to increase. Adjust the three bandpass coils for maximum output.

NOTE: Do not allow output to increase above about 1/4 of full rated output. On the TX-110-L this is about 2-3 watts and on the TX-110-H about 25 watts. When adjusting the bandpass coils and the output begins to go above these levels, simply decrease the amount of MIC. GAIN. If an ammeter is used instead of a wattmeter do not allow the readings to go above 5 amps on the TX-110-H and 3/4 amp on the TX-110-L.



## TX-110 TRANSMIT MODULE



ATLAS TX-110 TRANSCIVER BLOCK DIAGRAM

# ATLAS WARRANTY

THE ATLAS TX-110 IS GUARANTEED UNDER THE FOLLOWING SCHEDULE:

- (1) All components are guaranteed for one (1) year from date of purchase.
- (2) Workmanship is guaranteed unconditionally for one (1) year from date of original purchase.
- (3) If factory service is required within 30 days Atlas will pay surface freight both ways. After 30 days customer pays shipping cost to the factory, and Atlas pays return freight. After 1 year, customer pays both ways, plus a nominal service charge.
- (4) This warranty will be transferred to owners other than original purchaser, provided the new owner advises Atlas Radio in writing of his name, address, and date of purchase.

UNDER THE REGULATIONS OF THE MAGNUSON-MOSS WARRANTY ACT, THE ATLAS WARRANTY POLICY IS CLASSIFIED AS A LIMITED WARRANTY.

### **3. CARRIER FREQUENCY ADJUST**

Tune transceiver to 3.8 MHz. Connect A.F. Generator into MIC jack and dummy load/wattmeter into ANTENNA connector on rear panel of TX-110. Switch SSB-CW to SSB position. Set A.F. Generator to 1000 cycles. In order to key the transmitter it will be necessary to connect the tip of the MIC jack to ground. After keying the transmitter, increase MIC. GAIN. until wattmeter reads 40 watts with TX-110-H or 8 watts with TX-110-L. Sweep generator down to approximately 300 cycles. Locate carrier frequency adjust trimmer, item 17 page 23 of RX-110 manual, and adjust trimmer, if necessary, until wattmeter reads 10 watts on TX-110-H or 2 watts on TX-110-L.

### **4. CARRIER BALANCE ADJUST**

Tune to 3.8 MHz. Connect monitor scope and/or dummy load/wattmeter. Wattmeter with low output scale can be used in place of monitor scope. SSB-CW switch in SSB position, MIC GAIN full CCW. Insert microphone into MIC jack and key transmitter. Locate carrier balance trimpot, item 16 page 23 of RX-110 manual, and adjust for minimum scope deflection, or wattmeter reading. If readings are negligible (no reading on a wattmeter scale of 0-5 or 0-10 watts) no further adjustment is needed. If more is needed locate the phase balance trimmer next to carrier balance trimpot and adjust for minimum reading. Re-adjust carrier and balance trimpot for minimum reading. Jockey the two adjustments until minimum reading is achieved.

### **5. METER ADJUST**

The front panel meter indicates relative power output. This reading will vary with antenna loads, frequency, and high and low power models. The only adjustment available is for zero calibration and this can be done by moving the small black lever located on rear of meter. It will be necessary to remove top cabinet to make adjustment.



### **3. CARRIER FREQUENCY ADJUST**

Tune transceiver to 3.8 MHz. Connect A.F. Generator into MIC jack and dummy load/wattmeter into ANTENNA connector on rear panel of TX-110. Switch SSB-CW to SSB position. Set A.F. Generator to 1000 cycles. In order to key the transmitter it will be necessary to connect the tip of the MIC jack to ground. After keying the transmitter, increase MIC. GAIN. until wattmeter reads 40 watts with TX-110-H or 8 watts with TX-110-L. Sweep generator down to approximately 300 cycles. Locate carrier frequency adjust trimmer, item 17 page 23 of RX-110 manual, and adjust trimmer, if necessary, until wattmeter reads 10 watts on TX-110-H or 2 watts on TX-110-L.

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Tune to 3.8 MHz. Connect monitor scope and/or dummy load/wattmeter. Wattmeter with low output scale can be used in place of monitor scope. SSB-CW switch in SSB position, MIC GAIN full CCW. Insert microphone into MIC jack and key transmitter. Locate carrier balance trimpot, item 16 page 23 of RX-110 manual, and adjust for minimum scope deflection, or wattmeter reading. If readings are negligible (no reading on a wattmeter scale of 0-5 or 0-10 watts) no further adjustment is needed. If more is needed locate the phase balance trimmer next to carrier balance trimpot and adjust for minimum reading. Re-adjust carrier and balance trimpot for minimum reading. Jockey the two adjustments until minimum reading is achieved.

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ATLAS RX-110

Revised

# **ATLAS RX-110**

**AMATEUR BAND RECEIVER**

## **INSTALLATION and OPERATION MANUAL**

I. GENERAL INFORMATION

- A. INTRODUCTION
- B. SPECIFICATIONS

II. INSTALLATION

- A. FIXED
  - 1. AC SUPPLY
- B. MOBILE
  - 1. DC BATTERY CABLE (DCC-110)
  - 2. DC CONNECTIONS
  - 3. MOBILE MOUNTING KIT (MM-110)
- C. ANTENNAS
- D. HEADPHONES
- E. SPEAKER

III. OPERATION

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  - 1. POWER ON
  - 2. A.F. GAIN
  - 3. BAND SELECTOR
  - 4. MAIN TUNING
  - 5. TUNING DIAL
  - 6. PHONES
- B. REAR PANEL CONTROLS
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IV. CIRCUIT DESIGN

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- B. POWER SUPPLY
- C. TRANSCEIVER OPERATION
- D. SCHEMATIC/VOLTAGE CHART
- E. PARTS LIST

V. WARRANTY

## INTRODUCTION

Your Atlas RX-110 is designed to provide excellent reception in the 5 amateur bands, 10 through 80 meters, (28 to 29 MHz on 10 meters). Through careful value engineering, all unnecessary frills have been eliminated, producing a low cost, simple design, but one which will provide you with a high level of sensitivity, selectivity, and dynamic range which is comparable or superior to other receivers costing much more.

If you are a newcomer to amateur radio, you'll be pleasantly surprised to learn how easily you can tune in on radio hams from all over the world with just a random length of wire for an antenna. Later on when you acquire your Novice or General Class License, you can add the TX-110 Transmitter Module, and become one of the signals on the airways, communicating with other hams around the world.

The Atlas RX-110 represents a brand new concept in receiver/transceiver design. For the first time you have a high performance receiver which can be converted into a transceiver by simply plugging the Atlas TX-110 Transmitter Module into the rear connector. You have a choice of 15 watts input power with the TX-110-L, or 200 watts with the TX-110-H.

You'll find that the RX-110, in addition to being an excellent high performance receiver, is also well built with high quality components, and a high level of craftsmanship and quality control. If you ever need repair or servicing, you'll find that the people in our Customer Service Department are dedicated to making every Atlas owner a satisfied customer.

So, here's to many pleasant hours of DXing and eaves dropping with your Atlas RX-110 receiver.

73,

Herb Johnson, W6QKI

ATLAS RADIO, INC.

## RX-110

### II. INSTALLATION

#### A. FIXED

The RX-110 is designed to operate on a power source of 14 volts DC. DC power can be delivered to the receiver via the built in AC power supply which provides the 14 volts filtered and regulated for the circuits of the RX-110.

#### B. MOBILE AND PORTABLE

1. DCC-110. For mobile or portable operation DC power can be delivered to the receiver via a DCC-110 cable available from Atlas dealers. The DC cable is designed with built-in polarity and fuse protection, and is recommended when using battery power. Included with the cable is all necessary hardware.

#### 2. ALTERNATE DC CONNECTION

In the event that you do not use the DCC-110 cable, the receiver comes with two banana plugs for the positive battery lead. If the RX-110 receiver is used alone, it is only necessary to connect the positive lead to the bottom mounted banana plug. The battery lead should be on No. 16 or 18 gauge stranded wire of automotive type. A 3 amp in-line fuse should be installed in the positive lead. The banana jack connects to the negative battery lead.

If the RX-110 is used in conjunction with the TX-110 transmitter module, it is recommended that a 3 amp fuse be connected between the two banana plugs. Then connect the battery lead to the middle or upper banana plug. The wire should be of No. 10 or 12 gauge. A 25 amp. circuit breaker is supplied with the TX-110-H (200 watt version) and should be connected in series with the battery lead next to the battery. Fig. 1 illustrates the proper connection required between the RX-110 and battery.

## RX-110 SPECIFICATIONS

FREQUENCY COVERAGE: 3500-4000kHz;  
7000-7500kHz; 14,000-14,500kHz;  
28,000-29,000kHz.

FREQUENCY CONTROL: Tuning dial reads to 5kHz, with 1kHz increments on skirt of tuning knob. Accuracy of dial is plus or minus 10kHz when trimmer has been adjusted accurately at band center. Tuning rate on lower bands is 22kHz per revolution. On 10 meters tuning rate is double, or 44kHz/rev.

FREQUENCY STABILITY: Less than 2kHz drift during first 30 minutes. Less than 500Hz per hour after 30 minutes operation. Less than 100Hz shift with supply voltage change from 100 to 140 volts AC, or 11 to 15 volts DC.

SOLID STATE DESIGN: 4 IC's, 8 Transistors, 25 Diodes.

MODES OF RECEPTION: CW and SSB on Normally Used Sideband. Lower Sideband on 3.5 and 7MHz bands. Upper Sideband on 14, 21, and 28MHz bands.

CIRCUIT DESIGN: Single conversion to 5595kHz I.F., using double balanced diode ring, providing high dynamic range, at least 80db above noise floor of 130dBm. Triple tuned input filters provide high out of band rejection.

THIRD ORDER INTERCEPT point, +3dBm.

SELECTIVITY is 2.7kHz bandwidth at 6db down, 2.2 shape factor, 6 to 60 db. Ultimate rejection more than 100 db. 6 pole ladder crystal filter at 5595kHz.

SENSITIVITY is 0.25 microvolts at 50 ohms for 10 db signal-plus-noise to noise ratio on 3.5 through 21MHz bands, 0.4 uv at 28MHz.

IMAGE REJECTION better than 60 db. Internal spurious less than equivalent 2 uv signal.

AGC SYSTEM, less than 10 db audio output change from 5 uv to 3 volt signal input.

OVERALL GAIN, requires less than 2 microvolt signal for 0.5 watts audio output, (CW carrier with 1000Hz heterodyne).

AUDIO OUTPUT POWER, 2 watts at 10% distortion, 300 to 3000Hz, plus or minus 3 db, 4 ohm speaker load.

INTERNAL SPEAKER, 3 in. 4 ohm, 68 oz magnet. Front jack provides for plugging in headphones, disconnecting speaker.

HEADPHONES should be 500 ohms resistance, or greater. Low imp. phones may be used, but require a series resistor to reduce audio power.

REAR PANEL: Antenna Jack, RCA Phono Type. (Phono Plug included) 12 pin socket provides for plug-in of TX-110 Transmitter Module to form five band transceiver. A jumper plug is also included with RX-110 for operation without the transmitter module. Banana connectors provide for 12 to 14 volt DC operation from car battery or other battery supply (not included).

AC POWER CONSUMPTION: 100 to 130 volts AC, 50-60Hz, 10 watts with RX-110 alone, (Export model, 200-260 volts AC, 50-60Hz). With TX-110 Transmitter module, peak power consumption in transmit mode will be 40 watts, (Higher power for 200 watt Power Amplifier is supplied by separate AC supply).

DC OPERATION, 12 to 14 VOLTS. CURRENT DRAIN: 0.2 Amps, 12 to 14 volts, for RX-110 alone. With TX-110 Transmitter Module, peak current drain in transmit mode will be 2 amps. to low current line. High current line is for 200 watt Power Amp., if used, and peak current to this line in transmit mode will be 16 amps.

SIZE AND WEIGHT: 8 1/2 in. (20.6cm) wide, 3 3/4 in. (9.5 cm) cabinet height, 9 3/4 in. (28.4 cm) cabinet depth. 7 lbs. (3.2 Kg) net weight. 9 lbs. (4.1 Kg) shipping weight.

CONNECTOR PLUG  
TO RX-110

NEG  
GND

+10 AMPS

+11 AMPS

SLEEVING

IN-LINE  
3 AMP FUSE

TO NEGATIVE (-)  
BATTERY TERMINAL

25 AMP CIRCUIT  
BREAKER REQUIRED  
ONLY WITH TX-110-H  
TRANSMITTER MODULE

TO POSITIVE (+)  
BATTERY TERMINAL

ATLAS DCC-110  
CONNECTOR CABLE  
FOR DC OPERATION  
OF RX-110/TX-110

FIG. 1

### 3. MOBILE MOUNTING KIT (MM-110)

The mobile mounting kit is a plug-in unit designed for easy plug-in removal of the RX-110/TX-110 combination. All DC power connections are made to the MM-110 and all necessary hook-up cables, including the DC battery cable with circuit breaker and hardware are part of the kit.

### C. ANTENNAS

Any of the common antenna systems designed for use on the amateur bands may be used with the receiver. Antenna input is designed for 50 ohm input. For receiving only, any random length wire antenna can be used, but the receiver will not perform quite as well as when the antenna has been constructed for use on the amateur bands. Refer to figure 2 for recommended lengths of wire antennas for each amateur band.

On 10, 15, and 20 meters a dipole and most beam antennas will work well across the entire band. On 40 and 80 meters a typical dipole tuned for the band center is sometimes referred to as either the 75 or 80 meter band. The frequency between 3.5 and 3.8 MHz is considered the 80 meter band segment and from 3.8 to 4.0 MHz, the 75 meter band segment. For optimum reception and transmission antennas should be tuned to one band segment or the other. However, because of the difficulty in having more than one antenna of the length required for the 3.5 MHz band it is recommended that one antenna be tuned for the frequency that is likely to be used most often.

The dipole is the basic shortwave receiving and transmitting antenna. Its length is equal to about one-half the wavelength of the desired operating frequency. (The symbol for wavelength is  $\lambda$ ). It is usually made of wire and supported at the ends by insulators. The radiation and capture pattern of the horizontal antenna is bi-directional, perpendicular to the plane of the antenna. The dipole is broken at the center point and the 50 ohm coax cable feed line is connected,

The multi-element beam antenna is highly efficient for long distant communications. You will usually see these antennas mounted on high towers.

NOTE: Most of these types of antennas and books and magazines describing different kinds of antenna systems are available at most amateur radio dealers.

D. HEADPHONES

Headphones should be 500 ohms resistance or greater. If low impedance phones are used a resistor should be connected in series at the headphone plug to make the total resistance approximately 500 ohms. RX-110 requires a 3.5mm, 2 conductor miniature phone plug. Plug is available at your Atlas dealer or most Radio Shack stores. Also, a 1/4" to 3.5mm headphone plug reducer is available at Radio Shack.

E. SPEAKER

The speaker is mounted on the receiver chassis and faces through the bottom cover. If an external speaker is desired it is only necessary to remove the bottom cover of the RX-110, locate the two speaker terminals on the PC310 board and connect a two wire cable from the external speaker. If the internal speaker is not desired, remove the wires from the two terminals and tape to the bottom cover.

to the coax shield to one side; and the coax center conductor to the other side of the dipole. The total length of a wire dipole for any shortwave frequency may be computed from the following formula:

$$\text{Length in Feet} = \frac{468}{\text{Frequency MHz}}$$

EXAMPLE: Desired operating frequency is 14.3 MHz. The length of the half-wave dipole is: length =  $\frac{468}{14.3}$  or 32.7 feet end to end.

When space limitations restrict construction of lengthy horizontal antennas, the general coverage vertical antenna may be desired. The vertical antenna receives from all directions and transmits in all directions. They are usually a quarter wavelength in height and require a group of horizontal radials, preferably each being one quarter wavelength in length, spread equally around the vertical radiator. The length of a quarter wave element is Length in feet =  $\frac{234}{\text{Freq. MHz}}$

EXAMPLE: Desired operating frequency is 14.3 MHz. Vertical length is length =  $\frac{234}{14.3}$  or 16.3 feet. The 50 ohm coaxial cable is fed directly to the antenna. The coax shield is connected to the radial or ground system, and the center conductor is connected to the vertical radiator.

Multi-band vertical and horizontal antennas are also available for amateur band use. Band selection is made possible by the placing of resonant circuits known as "traps" along its length. Once the antenna has been installed there is no need for adjustments when bands are switched.

Directional beam type antennas are also available. Because of size limitations, this type of antenna is normally restricted to 10, 15, and 20 meter use only. This antenna is of the dipole type, but with additional elements added to increase both transmitting and receiving gain.

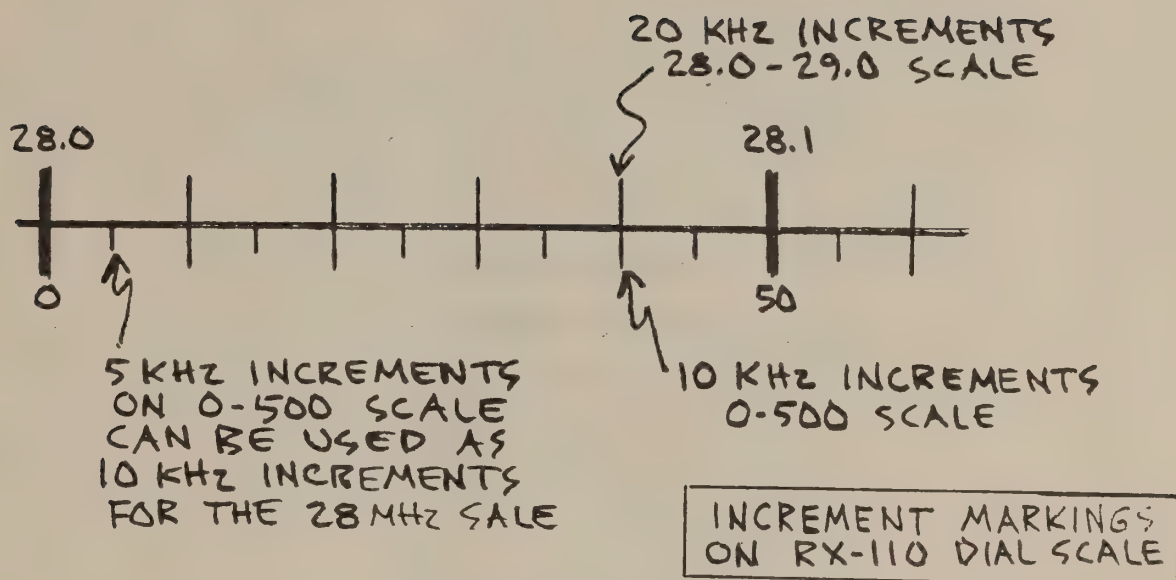


FIG. 3

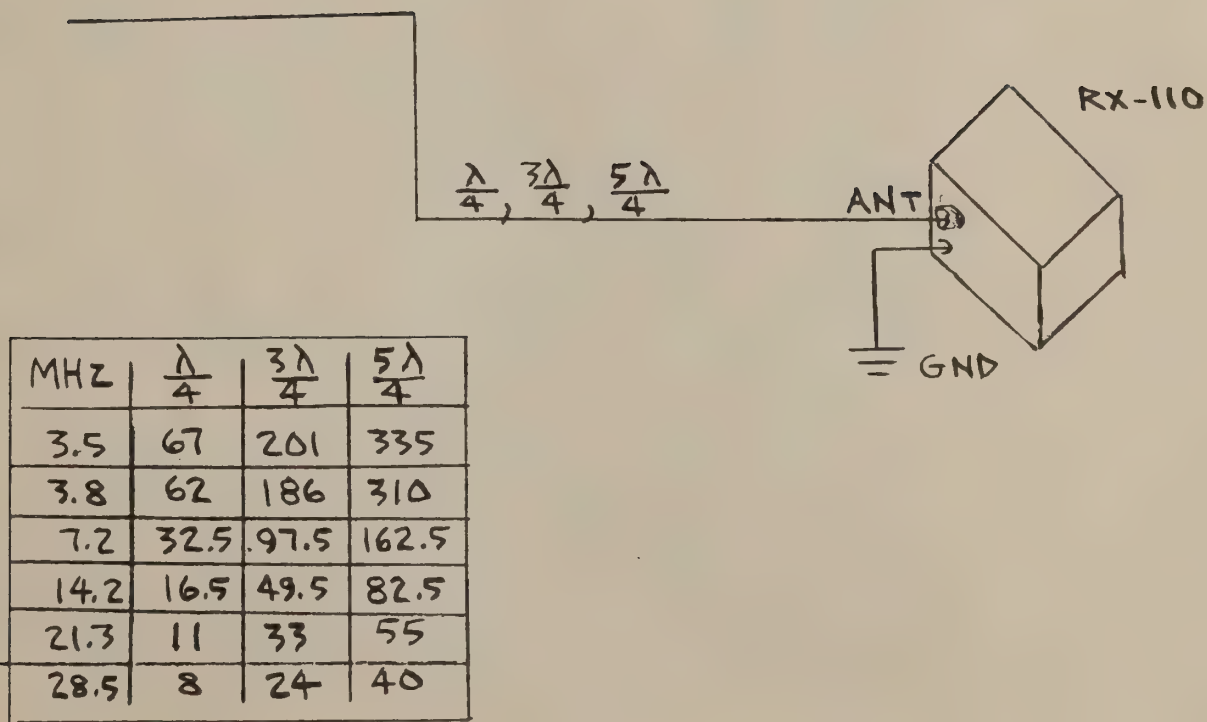


FIG. 2

### III. OPERATION

#### A. FRONT PANEL CONTROLS

1. POWER ON: The POWER ON switch is part of the A.F. GAIN control. When using either 117 VAC or 12 to 14 VDC for power, the switch must be on.
2. A.F. GAIN: Controls audio volume in receive.
3. BAND SELECTOR: Numbers read in MegaHertz for the respective amateur bands: 3.5 for 80 meters, 7 for 40 meters, 14 for 20 meters, 21 for 15 meters, and 28 for the first megahertz portion of 10 meters. (28 to 29 MHz).
4. MAIN TUNING KNOB: Velvet smooth tuning ratio provides for 22 kHz per revolution on lower bands and 44 kHz per revolution on the 28 MHz band. Increment markings on the tuning knob skirt are 1 kHz apart on the lower bands, and 2 kHz apart on the 28 MHz band.
5. TUNING DIAL: Illuminated analog dial scale is used on all bands. The 0-500 kHz dial scale reads directly on 7, 14 and 21 MHz bands. EXAMPLE: With BAND switch in 14 MHz position and tuning dial at 250 on the 0-500 kHz scale, the operating frequency is 14,250 kHz. On the 3.5 MHz band the dial scale reading is additive. EXAMPLE: With bandswitch in the 3.5 MHz position and tuning dial at 400 on the 0-500 kHz scale, the operating frequency is 3,900 kHz.

The 28 MHz band is calibrated directly above the 0-500 kHz scale and reads from 28.0 to 29.0 MHz. The 28 MHz, dial is calibrated in 20 kHz increments. However, by using the 5 kHz increments on the 0-500 kHz scale, it is possible to read down to 10 kHz on the 28.0 - 29.0 scale. See Figure 3.

Avoid the habit of tuning so that the voice is pitched higher than normal. This is an unfortunate habit practiced by a number of operators. Mistuning results in distortion on the voice and should be quite noticeable to the average ear. Some voices are relatively rich in harmonics and are easier to tune in than a person with a "flat" voice. There is no mistaking when you have a station tuned exactly right on. It will sound just like "AM" Broadcast signal.

6. PHONES: 3.5mm, 2 conductor miniature for headphones of 500 ohms resistance or greater.

### III. B. REAR PANEL CONTROLS

1. ANTENNA: RCA phono type (included with receiver) connects receiver with antenna system.
2. 14 VDC CONNECTORS: Connectors are used, when receiver is operated from a direct 12 to 14 VDC source. The two banana plugs are used for the positive voltage connections and the banana jack is for the ground connection. The lower mounted plug is used for the RX-110 receiver. Current drain is 0.2 Amps. When using the TX-110 transmit module, the lower mounted jack is also used. Peak current drain in the transmit mode will then be 2 Amps.

If the 200 watt power amplifier is used, the upper jack (high current) is connected and peak current to the line in transmit mode will be 16 Amps. Atlas DCC-110 cable is recommended for DC operation.

3. AC CONNECTION: For use when receiver is to be used with 100-130 volts AC, 50-60 Hz (200-260 volts AC, 50-60 Hz, EXPORT MODEL). Power drain is 10 watts for receiver alone. Peak power with TX-110 transmit module is 40 watts. Power for 200 watt power amplifier is supplied by separate AC supply.
4. TX-110 CONNECTOR: 12 pin socket provides for plug-in of TX-110 transmit module to form the 110 transceiver. A jumper plug is included with RX-110 for operation without the TX-110 Module.

### C. TUNING OF SINGLE SIDEBAND SIGNALS

Precise tuning of a single sideband signal is very important. Do not be satisfied to merely tune until the voice can be understood, but take extra care of setting the dial to the exact spot where the voice sounds natural.

After the crystal filter the I.F. signal goes to PC-310 where it is amplified by Q315, an MC1350P integrated circuit. Then it is coupled into one gate of Q314, a 40673 FET product detector. The BFO (Beat Frequency Oscillator), made up of Q312 and Q313, is coupled to the other gate, and the product coming from the FET drain will be the desired audio frequency signal, (voice signal). This audio frequency is coupled into Q316, an I.C. containing four Op. Amps. Section A is used for amplifying the audio signal, after which it is coupled through the A.F. Gain control to Q319, the LM380N power amplifier I.C. 2 watts of audio power is available for the 4 ohm loudspeaker.

Section B of Q316 also amplifies the audio signal, and then couples into the AGC rectifiers, producing a DC control voltage. Q318 amplifies this DC voltage, which is then fed to the gain control terminal of Q315, the MC1350P I.F. amplifier. This AGC loop results in a nearly flat gain curve, with less than 10 db change in audio output with signal variation from 5 microvolts to 1 volt. The remaining 2 sections of Q316 are unused.

#### B. POWER SUPPLY

The built-in AC transformer provides 12 volts RMS to a diode bridge (PC-080) to produce about 16 volts DC. Actual voltage varies with current drain being about 16.5 in receive mode and dropping to 12.5 at full transmit power. Q81 is an IC voltage regulator which provides 9 volts of highly filtered and regulated supply for the receiver. The only part of the receiver operating on the unregulated higher voltage is the output portion of the LM380N audio amplifier. It is rated up to 20 volts.

Primary voltage to the AC supply is 100 to 130 volts AC, 50 to 60 Hz in the domestic model. The export model has a 200 to 260 volt primary.

## IV. CIRCUIT DESIGN

### A. RECEIVER

The RX-110 is a single conversion superheterodyne circuit which combines high performance with minimum spurious responses, and minimum complexity. Exceptional dynamic range is achieved by coupling the received signal directly into a double balanced diode mixer without any pre-amplification. Dynamic range is the measure of a receiver's ability to reject very strong signals whose frequencies are outside the I.F. passband. The RX-110 utilizes the same basic circuit design employed in the Atlas 210X and 350XL transceivers, well known for their exceptional dynamic range and high performance when compared with other receivers which use FET pre-amplifiers and mixers.

Refer to the block diagram, schematic, and parts list in following the circuit description. The signal from the antenna is first coupled through the bandpass filters on circuit board PC050. These filters are triple tuned on each band in order to provide high rejection of image signals outside the amateur bands. After passing through the bandpass filters, the signal is coupled into the mixer stage on PC-110, where it is mixed with the local oscillator (VFO) on PC-410. The 5595 kHz I.F. product from the mixer is amplified by Q111, a 2N3866 transistor, and then coupled into a very selective crystal ladder filter. This is a 6 pole device which provides extremely steep skirt selectivity, resulting in exceptional adjacent channel rejection. This means that you can tune very close to a strong local signal without suffering from interference. Bandwidth of the filter at 6 db down is 2700 Hertz, which permits audio frequencies between 300 and 3000 Hz to pass. Bandwidth at 60 db down is only 5900 Hz, a 6 to 60 db shape factor of 2.2. Ultimate rejection exceeds 100 db.

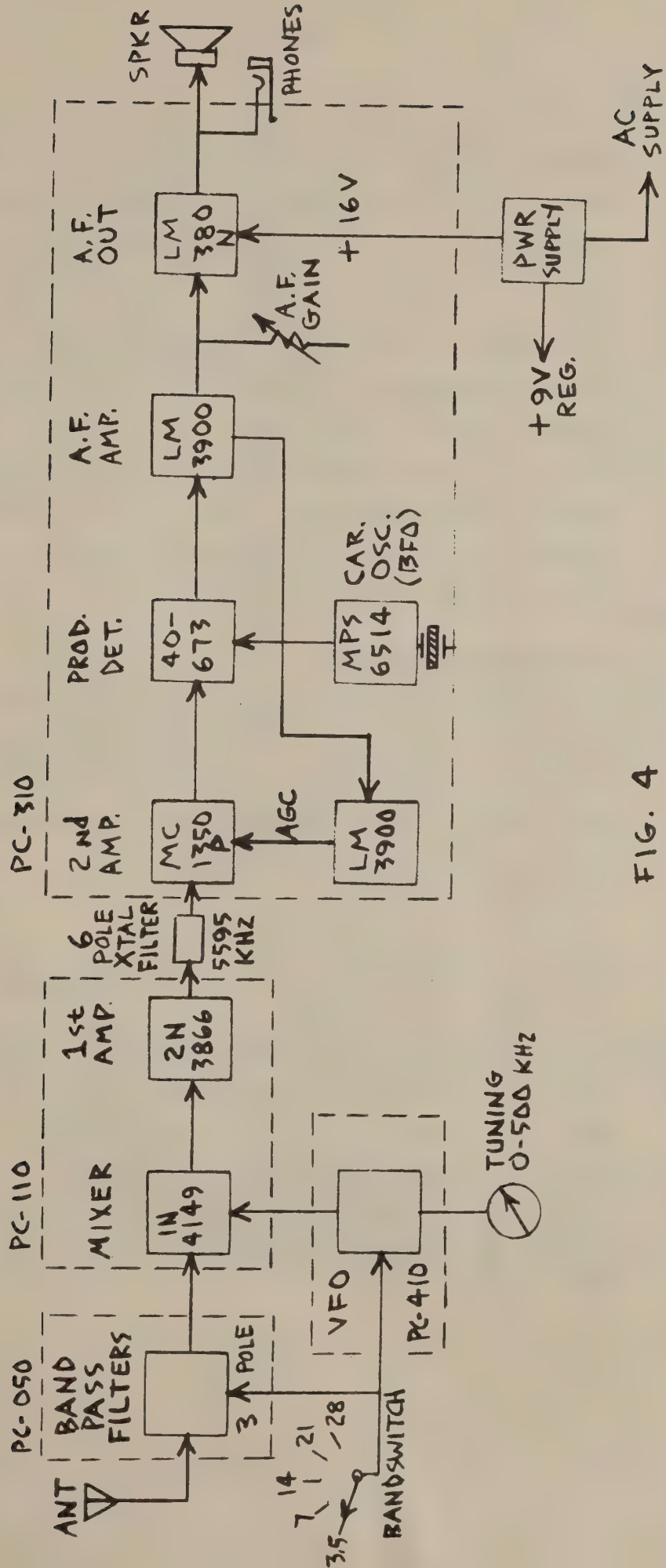


FIG. 4  
MODEL RX-110 BLOCK DIAGRAM

12 to 14 volts DC will operate the RX-110, with connections made at the rear banana plug and jack terminals. The Atlas DCC-110 cable kit is recommended for this purpose. Normally an auto type storage battery will be used for mobile or portable operation, although the RX-110 draws only 150 to 200 milliamperes, so will operate from a 12 volt lantern battery for several hours. With the TX-110 transmitter module connected, current drain will increase sharply during transmit.

A series diode in the RX-110 provides protection from accidental wrong polarity. This diode protects all circuits except the 200 watt transmitter amplifier, which is protected by a shunt diode contained in the DCC-110 cable kit.

#### C. TRANSCEIVER OPERATION

When the Atlas TX-110 Transmitter Module is plugged into the RX-110 receiver, the combination becomes a transceiver. The TX-110 alone is not a complete transmitter, since it requires the following circuits from the RX-110:

(a) The BFO (carrier oscillator), (b) Balanced Modulator  
(c) Crystal Filter, (d) IF Amplifier, (e) Diode Ring Mixer  
(f) VFO, and (g) Bandpass Filters.

The TX-110 contains a microphone amplifier, 800 Hz side-tone oscillator for CW, R.F. pre-amplifier for the transmit signal, driver stage, and push-pull 15 watt power amplifier. The 200 watt model of the TX-110 includes a 200 watt power amplifier, driven by the 15 watt stage. Low pass filters for each band, 10 through 80 meters, are selected with a bandswitch. These filters reduce harmonic output to meet FCC requirements. Typically harmonic output is down more than 50 db.

# PC-410 VFO BOARD

C411,415	.01 mf 100V 20% Disc	C432	4.7 pf N470 10% Disc
C412	.001 mf 100V 20% Disc	C435	22 pf NPO 5% Disc
C413	47 pf N1500 5% Disc	R411,420	470 5% $\frac{1}{4}$ watt
C414	68 pf N1500 5% Disc	R412	47K 5% $\frac{1}{4}$ watt
C416	4.7 pf NPO 10% Disc	R413	10K 5% $\frac{1}{4}$ watt
C417,418	68 pf 5% DM-15 Silver Mica	R414	1K 5% $\frac{1}{4}$ watt
C419	15 pf N150 5% Disc	R415	1.5K 5% $\frac{1}{4}$ watt
C420A,B	4 and 8 pf VFO Tuning Cap	R416	27 5% $\frac{1}{4}$ watt
C421,425,428,		R417	100K 5% $\frac{1}{4}$ watt
431,434	.8-12 pf Piston Trimmer	R418	330 5% $\frac{1}{4}$ watt
C422	10 pf N750 5% Disc	R419	150K 5% $\frac{1}{4}$ watt
C423,433	4.7 pf N750 10% Disc	L411	3.6 uH R.F. Choke
C424	4.7 pf N1500 10% Disc	L412	33 uH R.F. Choke
C426	10 pf N330 5% Disc	L413	Tapped VFO Coil
C427	10 pf N220 5% Disc	Q411	MPS6514 Transistor
C429,436	22 pf N330 5% Disc	Q412,413	2N4416 Transistor
C430	27 pf NPO 5% Disc		

## CHASSIS ASSEMBLY

B1	Dial Lamp, 9	E1	Speaker, 3.2 ohm
R1	A.F. Gain Pot, 10K	S1	Bandswitch
J1	Antenna Jack	S2	Power Switch (A.F. Gain Pot)
J2	Negative/Ground	P1	+14V Low Amps
J3	Connector	P2	+14V High Amps
J4	Headphone Jack	P3	RX-110 Jumper Plug
F1	6 Pole Crystal Filter, 5595 kHz		

### NOTE: QRP Operation

The TX-110-H transmitter module can be used for QRP operation (20 watts P.E.P. input) with an easy change.

First, remove both top and bottom covers. Then disconnect both Power Amplifier input and output phono plugs. These connectors are located near the middle of the chassis next to the large black heat sink. Connect the coax jumper cable (supplied in the TX-110-H packing carton) between the two phono jacks that were used by the Power Amplifier plugs.

The transmitter module is now wired for QRP operation. If complete removal of the Power Amplifier is necessary, unsolder the red and yellow wires from the terminal strip located on the inside rear panel next to the amplifier and remove the 4 screws holding the amplifier in place. Then carefully remove the Power Amplifier assembly from the chassis. This way the amplifier can be serviced without taking you off the air.

# PC-050 BAND PASS FILTER BOARD

C51,52	33 pf N750 5% Disc	L51,53	Coil, 9 uH Tapped
C53,54,55,63,64		L52	Coil. 9 uH
65,68,69,70	180pf FS 10% Disc	L54,56	Coil, 1.1 uH Tapped
C56,57	43 pf N750 5% Disc	L55	Coil, 1.1 uH
C58,59,60	470 pf FS 10% Disc	L57,59	Coil, .6 uH Tapped
C61,62,66,67	15pf N220 5% Disc	L58	Coil, .6 uH
C71,72	8.2 pf NPO 10% Disc	L60,62,63,65	Coil, .35 uH Tapped
C73,74,75	100 pf FS 10% Disc	L61,64	Coil, .35 uH

# PC-080 POWER SUPPLY BOARD

C81	4000 mf 25V Electrolytic	Q81	5-30V Voltage Regulator IC
C82,83	.0047 mf 150 VAC Disc	D81,82,83	
R81	3.3K 5% $\frac{1}{4}$ watt	84,85	MR-500 Diode Rectifier
R82	2.7K 5% $\frac{1}{4}$ watt	T81	Power Transformer

# PC-110 1st MIXER BOARD

C111,114,115,116	.01mf 100V 20% Disc	R118	100 5% $\frac{1}{4}$ watt
C112	200 pf FS 10% Disc	D111,112,113,114	
C113	680 pf FS 10% Disc	115,116	1N4149 Silicon Diode
R111,117	1K 5% $\frac{1}{4}$ watt	Q111	2N3866 Transistor
R112,113	3.3K 5% $\frac{1}{4}$ watt	T111,112	Trifilar Toroid Xfmr
R114	270 5% $\frac{1}{4}$ watt	T113	Shielded I.F. Xfmr, 5595 kHz
R115	220 5% $\frac{1}{4}$ watt	L111	200 uH R.F. Choke
R116	10 5% $\frac{1}{4}$ watt		

# PC-310 I.F. & AUDIO AMP. BOARD

C311	40 pf Trimmer Cap	R318,347,354,355,	
C312	150 pf FS 10% Disc	356,357	2.2K 5% $\frac{1}{4}$ watt
C313	270 pf FS 10% Disc	R319,335,349,350,351	10K 5% $\frac{1}{4}$ watt
C314,316,318,320,321,		R321	27 5% $\frac{1}{4}$ watt
323,324,325,326,329,		R327	4.7K 5% $\frac{1}{4}$ watt
331,345	.01 mf 100V 20% Disc	R328	5.6K 5% $\frac{1}{4}$ watt
C315	15 pf N150 5% Disc	R331	100K 5% $\frac{1}{4}$ watt
C317	20 pf Trimmer Cap	R336,346	1 Meg 5% $\frac{1}{4}$ watt
C319	39 pf NPO 5% Disc	R337,347	3.3K 5% $\frac{1}{4}$ watt
C322	100 pf FS 10% Disc	R338,353	330 5% $\frac{1}{4}$ watt
C327,340,343,347	2.2 mf 16V Tantalum	R339	1K Trimpot
C328	130 pf FS 10% Disc	R341	220K 5% $\frac{1}{4}$ watt
C330	47 mf 16V Electrolytic	R343	10 Meg 5% $\frac{1}{4}$ watt
C332,333,337,338,		R345,348	2 Meg 5% $\frac{1}{4}$ watt
341,342,344	.1 mf 12V 20% Disc	R352	470 5% $\frac{1}{4}$ watt
C334,335	220 mf 16V Electrolytic	D311,312,313,314,	
C336	.05 mf 25V 20% Disc	315,316,319,320	
C339	68 pf NPO 5% Disc	321,322,323,324	1N 4149 Sil. Diode
C346	22 mf 25V Electrolytic	D317,318	BA182 Sil. Diode
C347	100 mf 16V Electrolytic	Q311,312,313,320	MPS6514 Transistor
C349	.47 mf 100V Mylar Cap	Q314	40673 Transistor
C350	220 mf 25V Electrolytic	Q315	MC1350P I.F. Amp. IC
R311,344	6.8K 5% $\frac{1}{4}$ watt	Q316A,B	LM3900 AGC & AF Amp. IC
R312,323,324,325,330,333	1K 5% $\frac{1}{4}$ watt	Q317	2N5486 Transistor
R313,320,332	220 5% $\frac{1}{4}$ watt	Q318	MPS-A-12Transistor
R314	100 Trimpot	Q319	LM380 A.F. Output IC
R315,340	47K 5% $\frac{1}{4}$ watt	T311	Trifilar Toroid Xfmr
R316,322,326,329,334	100 5% $\frac{1}{4}$ watt	T312	Shielded I.F. Xfmr, 5595kHz
R317	33K 5% $\frac{1}{4}$ watt	Y311	5595 kHz Series Res. Xtal



## ATLAS WARRANTY

THE ATLAS RX-110 IS GUARANTEED UNDER THE FOLLOWING SCHEDULE:

- (1) All components are guaranteed for one (1) year from date of purchase.
- (2) Workmanship is guaranteed unconditionally for one (1) year from date of original purchase.
- (3) If factory service is required within 30 days Atlas will pay surface freight both ways. After 30 days customer pays shipping cost to the factory, and Atlas pays return freight. After 1 year, customer pays both ways, plus a nominal service charge.
- (4) This warranty will be transferred to owners other than original purchaser, provided the new owner advises Atlas Radio in writing of his name, address, and date of purchase.

UNDER THE REGULATIONS OF THE MAGNUSON-MOSS WARRANTY ACT, THE ATLAS WARRANTY POLICY IS CLASSIFIED AS A LIMITED WARRANTY.

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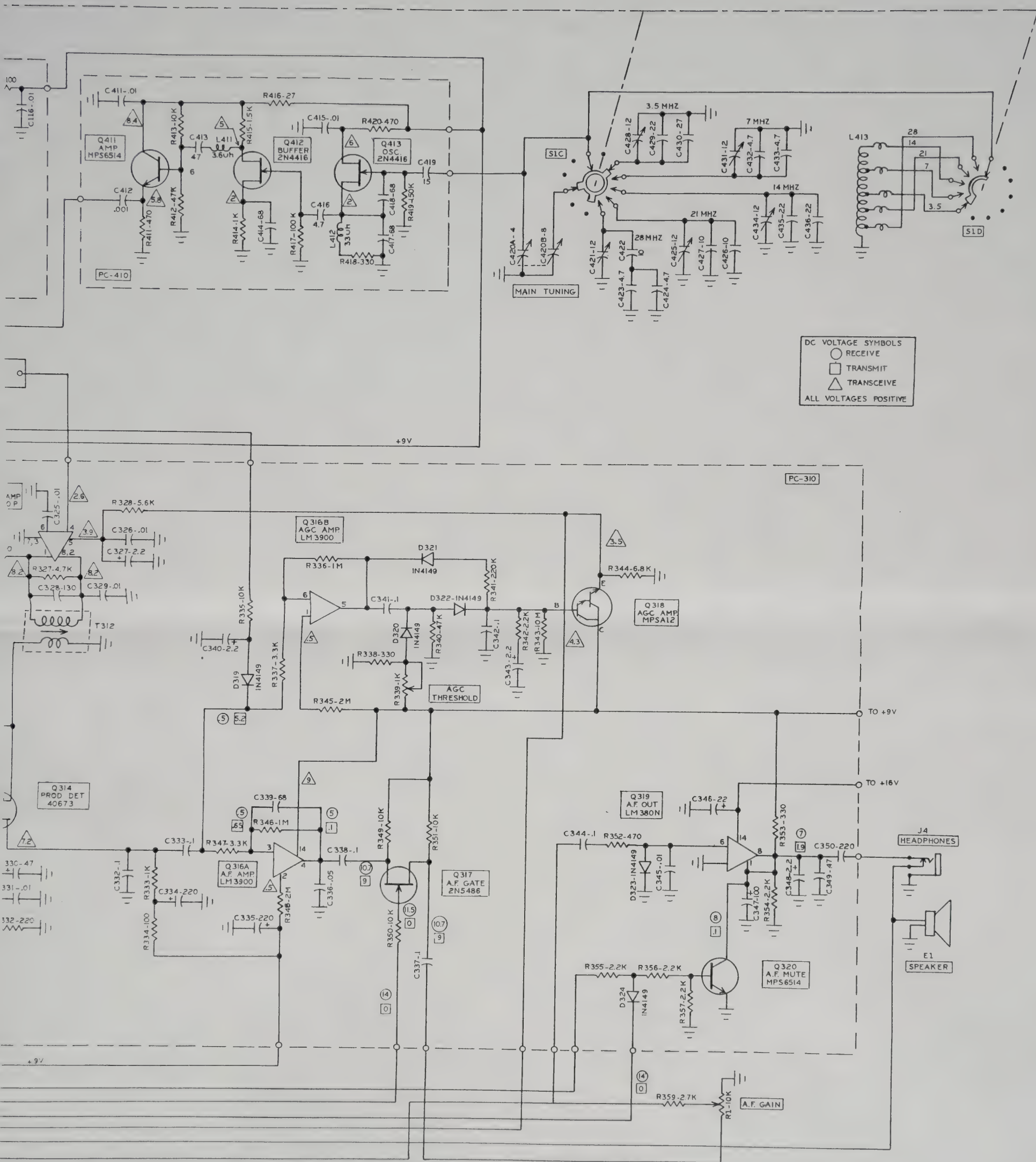
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